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NORTH BOUNDARY CONTAINMENT / TREATMENT SYSTEM PERFORMANCE REPORT

ROCKY MOUNTAIN ARSENAL, DENVER, COLORADO

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Volume I

by

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13. ABSTRACT (Maximum 200 words) OBJECTIVES OF THIS TWO VOLUME REPORT INCLUDE: 1. EVALUATING THE EFFECTIVENESS OF THE NORTH BOUNDARY SYSTEM IN PREVENTING THE OFF-POST MIGRATION OF CONTAMINATED GROUND WATER 2. COLLECTING AND EVALUATING HISTORICAL, GEOLOGIC, WATER LEVEL, AND CHEMICAL DATA WHICH WILL ASSIST IN THE OVERALL PERFORMANCE ASSESSMENT 3. IDENTIFYING AND RECOMMENDING ENGINEERING, OPERATIONAL, AND MONITORING IMPROVEMENTS WHICH WILL ENHANCE LONG-TERM OPERATIONS. VOLUME I DISCUSSES THE HISTORY AND PLACEMENT OF THE SYSTEM, GEOLOGY, HYDROLOGY, CONTAMINANT DISTRIBUTION, AND SYSTEM EFFECTIVENESS. IT ALSO CONTAINS SAMPLE COLLECTION PROTOCOL, PLANT OPERATION LOG, WATER FLOW CHART, CHEMICAL ANALYSES OF PLANT INFLUENT AND EFFLUENT, AND ANALYTE CONCENTRATIONS IN DEWATERING WELLS. VOLUME II CONTAINS GEOLOGY AND HYDROLOGY MAPS AND CONTAMINANT DISTRIBUTION PLATES.					
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PREFACE

This study was conducted between November 1984 and May 1985 by personnel from the Compliance and Monitoring Branch, Technical Operations Directorate, Rocky Mountain Arsenal (RMA) and the Geotechnical Laboratory (GL) and Environmental Laboratories (EL), USAE Waterways Experiment Station. This report was written by Messrs. Edwin W. Berry and Brian L. Anderson of the RMA, Messrs. James H. May and Richard L. Hunt of the GL, and Mr. Douglas W. Thompson of the EL. Mr Berry served as coordinator for the study. The study and report were authorized by the Commander of RMA, LTC Craig M. Dexter.

The authors wish to express their appreciation to the following individuals for their input and support: Messrs. Rudy Sweder, Richard D. Englebrecht, and Greg Ward, RMA; personnel from Shaman Inc., Brighton, CO; and Jack H. Dildine, EL.

It is noted during the preparation of this report that the authors and contributors to this effort have a cumulative 64 years experience relating to the Contamination Control Program at RMA.

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NORTH BOUNDARY CONTAINMENT/TREATMENT
SYSTEM PERFORMANCE REPORT

PART I: INTRODUCTION

Background

1. The Rocky Mountain Arsenal (RMA) occupies over 17,000 acres in Adams County, Colorado. Figure 1 shows the Arsenal location in proximity to Denver, CO and identifies the location of the study area. The property occupied by RMA was purchased by the government in 1942. Throughout World War II, RMA manufactured and assembled chemical intermediate and toxic end-item products, and incendiary munitions. After the War, many different types of obsolete ordnance were destroyed at RMA by detonation or burning. During the 1950's, RMA produced GB nerve agent and filled munitions with the agent until late 1969. Since 1970, RMA has been involved primarily with the demilitarization of chemical warfare material by caustic neutralization and incineration. In addition to these military operations, portions of the Arsenal have been leased to private industries since 1946 for the manufacture of chemicals including various pesticides and herbicides.

2. Industrial wastes generated from both Army and lessee activities were routinely discharged into several unlined evaporation basins located on the Arsenal. This practice continued until 1956 when Basin F was constructed with an asphalt liner. Solid wastes have been buried at various locations throughout the Arsenal. Unintentional spills of chemicals have occurred in and around the manufacturing complexes at RMA. These actions have resulted in the migration of contaminants into the environment and, in particular, the contamination of portions of the shallow alluvial aquifer at RMA.

3. Contaminants were found to be migrating across the Arsenal boundaries in the early 1970's. The major contaminants identified at that time included chloride, diisopropylmethyl phosphonate (DIMP), and dicyclopentadiene (DCPD). As a result of this discovery, the Army established a contamination control program in 1975. The goals of this program were to define the nature and extent of the contamination problem and to develop response actions to control the contaminant migration. Numerous monitoring wells were placed across the

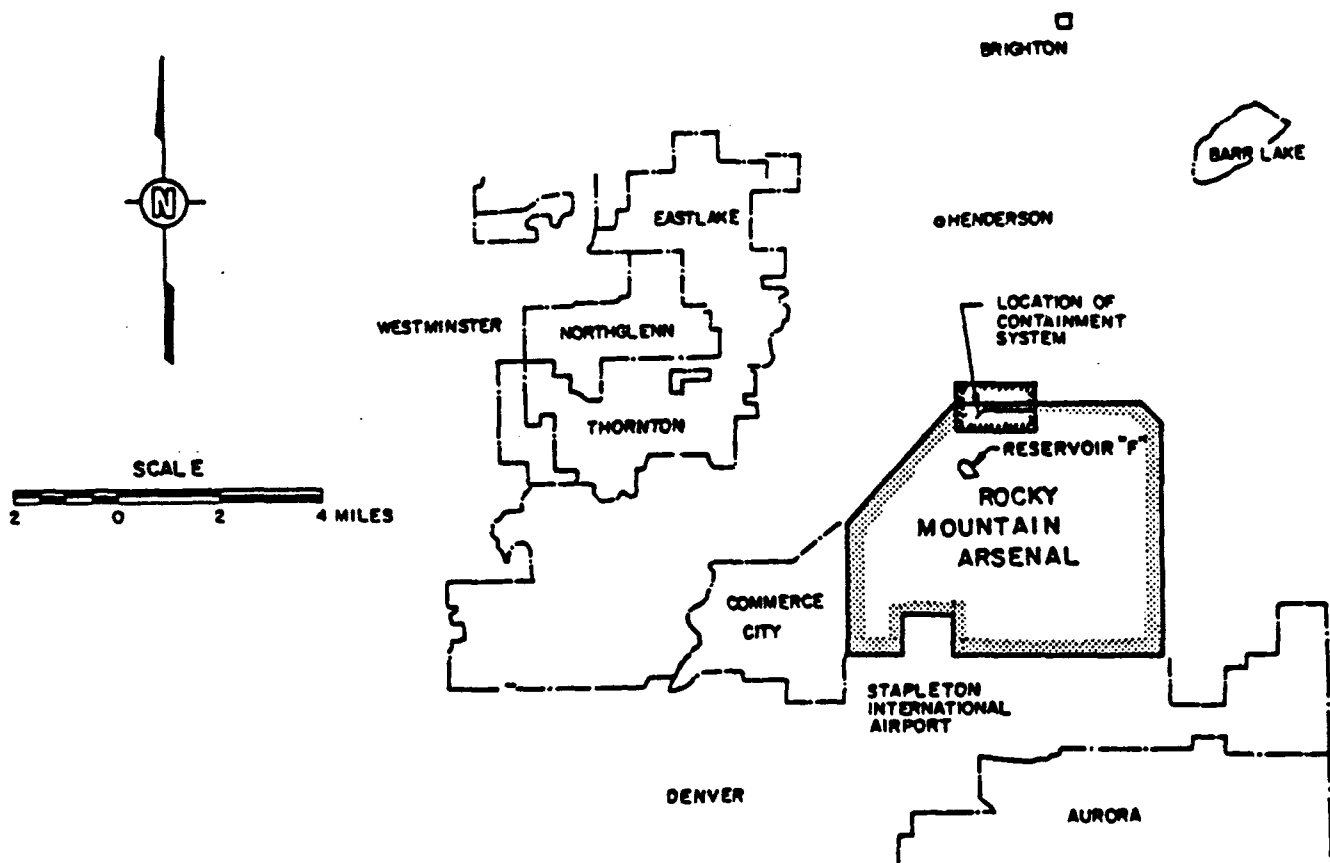


Figure 1. Vicinity Map

Arsenal and a sample collection and analysis program was initiated. The resulting data were used to develop an overall picture of ground water movement and of the types and distribution of contaminants in the ground water at RMA. The Basin F, Basin A, and South Plants areas of the Arsenal were identified as the primary sources of contaminants. The major contaminants found included organo-phosphorous compounds organo-sulfur compounds, and chlorinated pesticides.

4. Based on the data collected from the monitoring program, a plan was developed which included near-term control of contaminant migration through use of ground water control systems located along the Arsenal boundaries and long-term control through removal or control of the sources of contaminants. Under the plan, the boundary control systems would eliminate the migration of contaminated ground water off the Arsenal.

5. During the Fourth Quarter 1977, ground breaking was started for construction of a pilot containment/treatment system at the North Boundary of RMA in Section 23, 250 ft south of the RMA property line. The pilot system consisted of six ground-water collection wells, a 1500-ft bentonite barrier, granular activated carbon treatment and 12 recharge water wells (Figure 2). Monitoring wells were installed in Sections 23 and 24 on-post and in Sections 13 and 14 off-post north of RMA. The purpose of the pilot system was to establish the feasibility of barrier containment in dealing with alluvial ground-water contamination and to collect data required for the development of a full-scale containment system. In terms of the design and operational philosophy the following elements were incorporated into the containment system.

- a. Actual hydrologic control, and therefore, the containment of groundwater, is achieved via the alignment of dewatering and recharge wells.
- b. Due to the geohydrologic character of the north boundary alluvium, the design choice made was one line of dewatering wells placed in close proximity to one line of recharge wells.
- c. The overall system alignment was placed as close to the installation property line as possible to accelerate the off-post flow of clean treated water.
- d. The close proximity of dewatering and recharge wells to one another dictated that a physical barrier be placed between the alignments to prevent the recirculation of clean water from the artificial mound of groundwater near the recharge wells to the

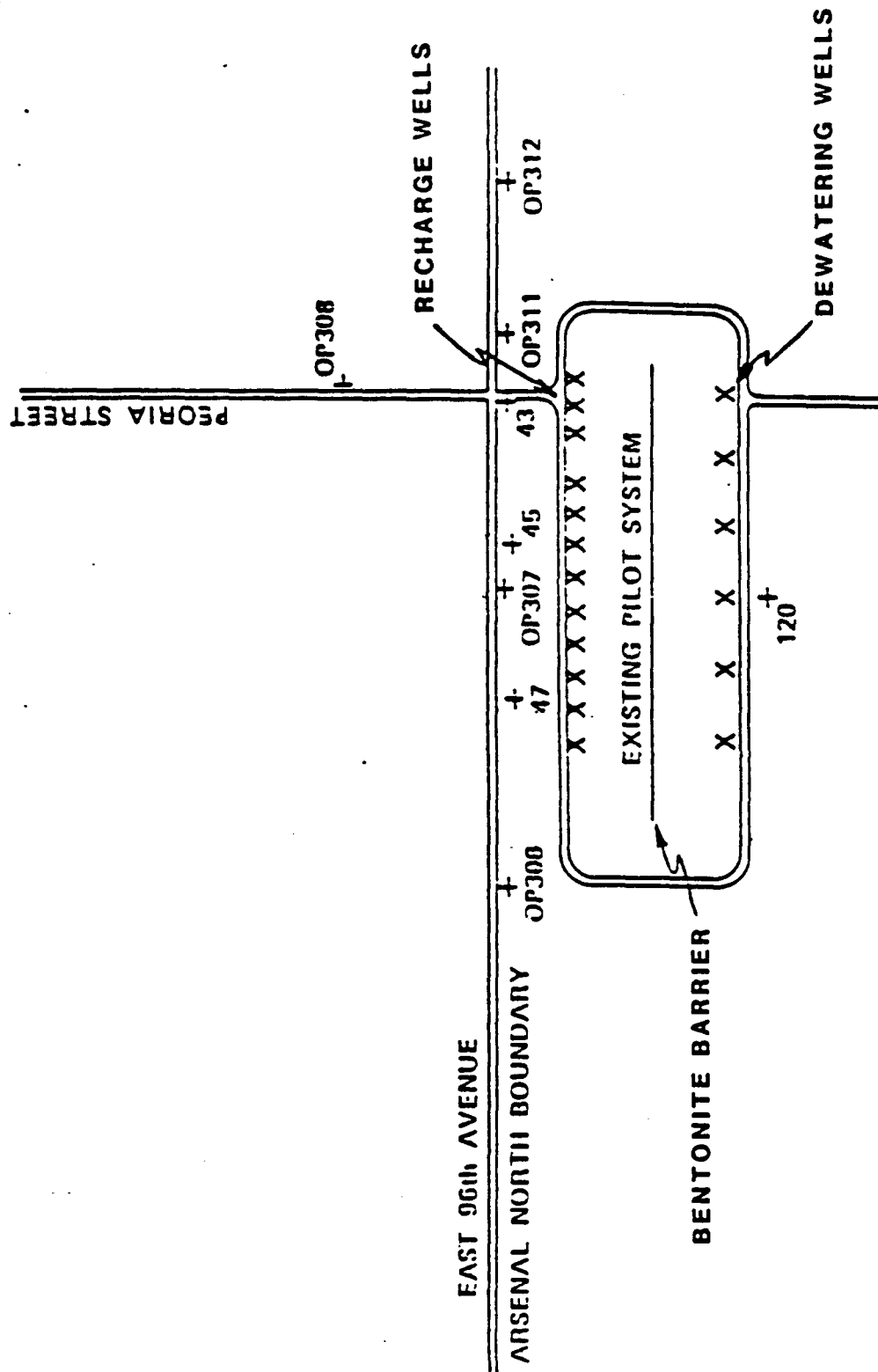


Figure 2. North Boundary Containment System

dewatering wells. An added advantage of a physical barrier was the "damming" effect that would be created if the dewatering wells shut down.

The RMA demonstration system was the first of its type built to address a major ground-water contamination problem. The pilot system started operations in June 1978.

6. Initial plans to expand the pilot containment/treatment system included an extension of 1700 ft to the east of the existing system for a proposed total length of 3200 ft. This proposal was based on extensive evaluation of the distribution of contamination in the alluvial aquifer and the Colorado Department of Health's statement in May 1977 that the quality of reinjected water meet drinking water standards as defined in "Standards for the Quality of Water Supplied to the Public." Findings of the National Academy of Science relative to guidelines for DIMP and DCPD concentrations were also incorporated except that the concentration of DCPD was further lowered from 1.28 ppm to a threshold odor number of 3 (.024 ppm) to improve the aesthetics of the treated water. The 1700-ft expansion was never constructed although considerable design engineering, geologic, and hydraulic studies were conducted toward this objective.

7. In June 1979, the Colorado Department of Health after reviewing the proposed 1700-ft expansion concept, stated that the north boundary system would be required to intercept and treat ground-water flow which contained DBCP above a detection limit of 0.2 ppb. The Army was requested to reevaluate the 1700-ft extension based on the revised treatment criteria and to collect new analytical data from east and west of the pilot system. The introduction of the 0.2 ppb DBCP treatment requirement late in the design process resulted in RMA notifying its command in August 1979 that the linear extent of the barrier would need to be extended by an amount more than twice the original pilot system, and that a greater barrier depth was required based on the discovery of DBCP contaminants in upper Denver sand units along the system alignment.

8. During May 1979, technical discussions between RMA and the Colorado Department of Health centered on the technical feasibility and benefits of constructing a 1200-ft segment of the proposed 1700-ft expansion immediately to intercept a DBCP plume which was passing around the east end of the pilot system. This proposal was withdrawn due to the fact that a major redesign was already in process, the expanded system schedule had slipped 4 months due to

the new DBCP standards, and due to the fact that the existing carbon treatment system could not treat the additional volume.

9. In May 1979 it was agreed by all parties that the pilot containment/treatment system would be expanded 3840 ft to the east (crossing First Creek) and 1400 ft to the west for a total proposed barrier length of 6740 ft. The major elements of the final system design are shown on PLATE 1 and are described as follows:

- a. Extend the bentonite barrier to a total length of 6740 ft.
- b. Install 29 additional alluvial dewatering wells upgradient and 26 additional recharge wells downgradient.
- c. Install 19 Denver sand unit dewatering wells upgradient.
- d. Expand the treatment building 25 ft in length.
- e. Install a First Creek crossing.
- f. Install three government owned carbon adsorbers to replace the leased units.
- g. Design a fluoride treatment system and determine the need for installation.

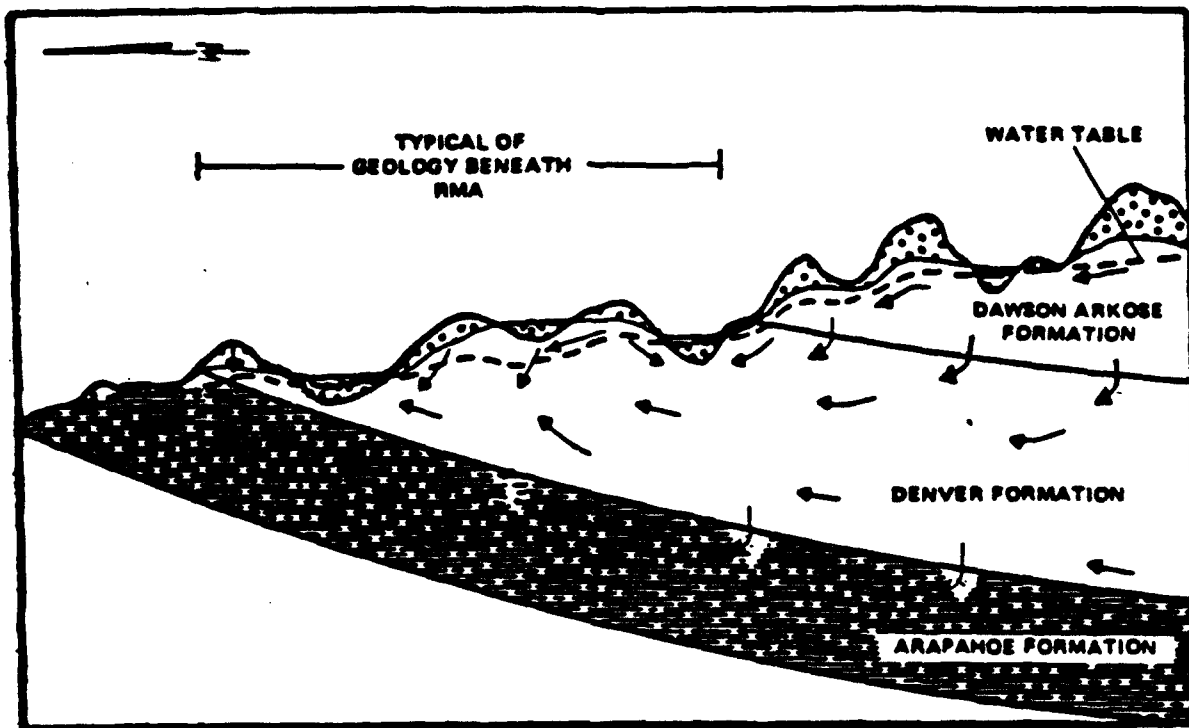
This was constructed and began operations in Jan 1982.

System Description

Geologic and Hydrologic Setting

10. Along the North Boundary, the two stratigraphic units of concern are the alluvium and the underlying Denver formation (Figure 3). The alluvium is composed of silts, clays, sands, and gravels. The alluvium is approximately 20 ft to 30 ft thick in the vicinity of the containment system. The alluvium has an approximate 10-20 foot saturated thickness at the North Boundary at a depth 5 to 15 ft below ground surface. The Denver Formation which underlies the alluvium is composed mainly of clay shale and claystone interbedded with some fine to medium grained sand units. Within the Denver formation there are localized saturated sand units with artesian conditions.

11. In the vicinity of the containment system, the ground-water flow is northward between two bedrock highs. The ground-water flux in the alluvial aquifer at the North Boundary was originally estimated at 640,000 gallons per day (444 gpm). Flow measurements and water level data indicate that the actual flows appear to be in the range of 250-325 gpm. Normally, the permeability in the alluvium is three orders of magnitude larger than in the Denver sands.



NOTE:
 ← GENERAL DIRECTION OF
 GROUND WATER MOVEMENT
 ALLUVIUM

Figure 3. Generalized cross sections across the Denver Basin showing lateral updip flow in the Denver formation (Robson and Romero 1981)

Containment and Treatment System

12. The North Boundary system incorporates 54 dewatering wells upgradient of a bentonite slurry wall to intercept the natural flow of ground water approaching the boundary. Thirty-five dewatering wells are screened in the alluvium and 19 dewatering wells are screened in the deeper Denver sand units. The bentonite barrier is 6740 ft in length, approximately 3 ft wide with a permeability of 1×10^{-7} cm/sec or less. The barrier depth varies from 20 ft at the pilot system to over 40 ft along the eastern extension. The barrier is anchored in the Denver Formation. The system was designed to remove, treat, and inject clean treated ground-water flowing through the North Boundary area in both the alluvium and upper Denver sands.

13. The dewatering wells are divided into three collection manifolds that intercept and dewater separate segments of the aquifer. PLATE 1 shows the manifold alignment. Manifold A is the westward most section of the system and contains 12 alluvial dewatering wells and 11 Denver sand wells. These are alluvial wells 301 through 306 and 330 through 335 and Denver Wells 336 through 343. Manifold A primarily intercepts the DIMP plume. Manifold B begins east of D street and only includes 12 alluvial wells. Manifold B intercepts the DBCP plume. Manifold C includes the easternmost section of the system alignment and is made up of 11 alluvial wells and 8 Denver wells. Manifold C intercepts trace concentrations of DBCP. Ground water from each manifold is fed to a separate sump prior to entering the carbon adsorption treatment system. The use of separate adsorbers optimizes carbon bed life and removal efficiencies. The treatment system is made up of a cartridge-type prefilter to remove suspended solids from the water, three 30,000 lbs up-flow pulsed-bed carbon adsorbers, a carbon transfer and storage vessel, and a cartridge-type postfilter (Figure 4). Treated ground water is discharged to a common sump prior to recharge.

14. Recharge to the alluvium is accomplished through 38 reinjection wells located downgradient of the slurry wall. The treated water is gravity fed to the 38 wells which are spaced to allow a continued diffusion and dispersion in a manner similar to that which occurred prior to the system implementation. All recharge is to the alluvium including the treated groundwater from the Denver sands dewatering wells. Since the intercepted Denver sands are updipping and outcrop soon after the barrier alignment, the primary flow rates in the alluvium are maintained.

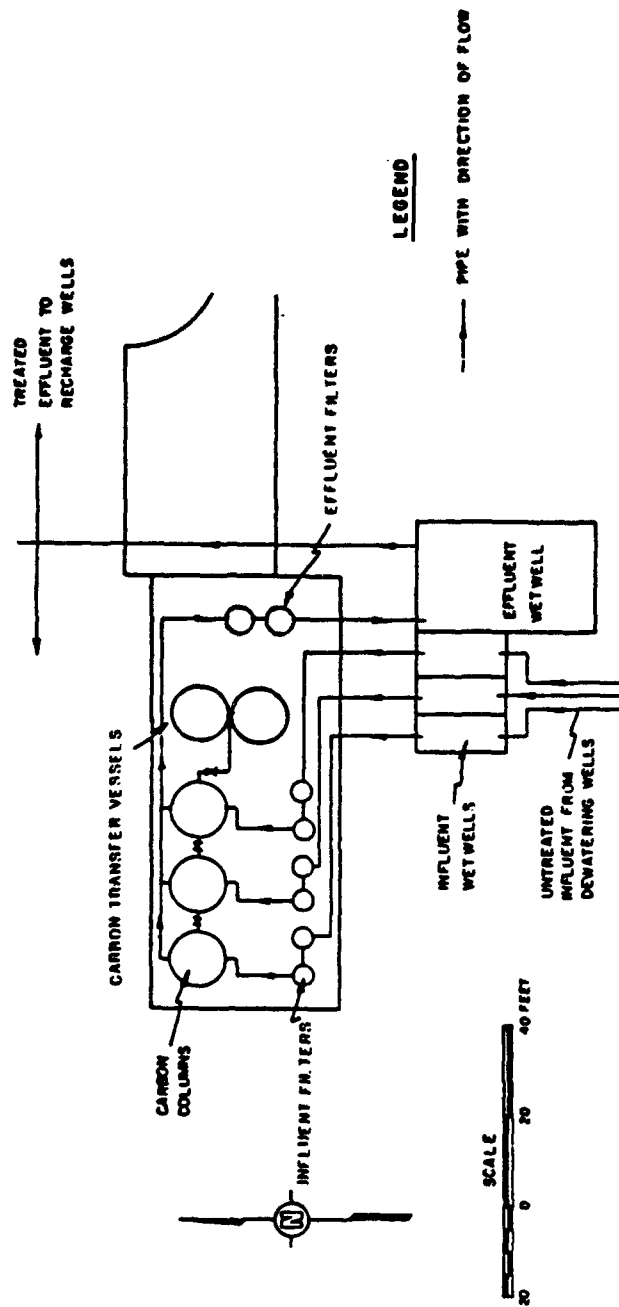


Figure 4. Ground Water Treatment Facility

Contaminant Distribution

15. To understand the extent of contamination in the groundwater it is noted that organic constituents above the applicable drinking water criteria were found in the alluvium throughout the North Boundary Area. Marginal levels of select contaminants were found during early sampling in the upper Denver sands which were hydrologically connected with the alluvium.

Report Objectives

16. Report objectives include:

- a. To evaluate the effectiveness of the expanded North Boundary System in preventing the offpost migration of contaminated ground water during four recent time periods generally covering FY84.
- b. To collect and evaluate historical, geologic, water level and chemical data which will assist in the overall performance assessment.
- c. To establish a comprehensive reference report for future evaluations.
- d. To identify and recommend engineering, operational, and monitoring improvements which will enhance long-term operations.

Approach

17. The approach was to utilize the in-house government personnel, those most directly responsible for the base line studies, the day-to-day operations, and the system monitoring data, to evaluate the effectiveness of the control system. The areas investigated included Sections 23, 24, and portions of 25 and 26 onpost, and Sections 13 and 14 offpost. Historical water level and contaminant data were used along with current chemical and water level data to provide the capability to assess trends. A chronology of engineering data from plant operations was developed from daily logs and reports to assist in evaluation of flow through the plant. Additional maps were developed by the Waterways Experiment Station, Vicksburg, MS, from the 1977, 1979, and 1983 time frame which provided a baseline setting upon which the current data base could be evaluated.

PART II: DATA COLLECTION

Monitoring Programs

18. Several monitoring programs have been conducted in the North Boundary project area between 1977 and 1984. Much of the early work (1977-1981) consisted of hydrogeologic and ground-water contamination investigations that supported design and construction efforts for the proposed boundary system. Programs that were directed more towards monitoring of the system were initiated after completion and start-up of the system in 1982. During the later part of 1982 and into 1983, the monitoring effort primarily involved the collection of water quality data. In late 1983, the need for a comprehensive monitoring program for use in system evaluation was identified and such a plan was developed and implemented during 1984. This plan incorporated a water quality and water level monitoring program that utilized the same monitoring sites and sampling methods. The sampling effort varied somewhat during the 1982-1984 period based on priorities and available manpower resulting in some inconsistencies in the monitoring program.

19. The method of ground-water sample collection has been modified over the period 1977 through 1984 to improve the representativeness of the samples. Initially a bailing procedure was used to collect water samples and steel tapes or electric probes were used to measure water levels. This procedure was considered appropriate since the ground water in the area was heavily contaminated and the wells in the area were generally installed in such a manner that stagnation was not a problem. As deeper monitoring sites were installed and lower levels of ground-water contamination were encountered, a need to improve the data collection procedures became evident. In addition, it was desired to implement a consistent procedure over the entire Arsenal.

20. A sample collection protocol, reproduced in Appendix A, was developed by RMA for the monitoring and investigative programs. This protocol was followed for ground-water sample collection on the North Boundary program starting in 1983. The methods used for water level monitoring have not changed although a more comprehensive effort is being conducted to collect complete data sets. Water samples were collected and provided to the Analytical Systems Branch at RMA for analysis. All the organic analysis was done using

gas chromatography instrumentation with the exception of the DCPD analyses in 1984 when a gas chromatography/mass spectrography instrument and method was used. Inorganic analyses were done using Technicon and other instrumentation.

Data Management

21. The sample analysis and water level data are maintained on the RMA and USATHAMA computer data systems. Prior to entry into the computer the data are verified by personnel in the Compliance and Monitoring Branch. Data sets were prepared and then used to construct data tables, maps, graphs, etc. Because of the amount of data utilized in developing this report, all of the raw data have not been reproduced. Numerous maps and charts summarizing these data are contained in this report. If raw data are required, they can be obtained through the Rocky Mountain Arsenal Information Center.

PART III: SYSTEM OPERATION

Operational History

22. A log of plant operations for the North Boundary system is maintained by the plant operator with major events documented on a weekly basis. The section of this log covering operation between October 1983 and October 1984 has been reproduced and is presented in Appendix B. The log contains comments on the operation, maintenance, and repair of the dewatering and recharge wells, pipes, electrical components, sumps, and treatment equipment. The log notes numerous problems occurring during the year which significantly affected the normal operation of the system. In particular, certain dewatering and recharge wells were inoperable for long periods of time. Many of the mechanical problems occurring during the year were due directly or indirectly to freezing of system components and lightning strikes. The wells and much of the piping lack adequate protection against freezing. Most of the pumps in the wells operate intermittently which tends to aggravate the freezing problems. Each well head has associated with it check valves, balancing valves, and a flowmeter which are all susceptible to freezing and breaking. The electrical control system which allows for the control of pumps and valves for both the well system and the treatment system sustained significant damage on several occasions from lightning strikes. Mechanical failures can go unnoticed for extended periods of time since the system is manned only during normal working hours. The failures can multiply by the time the operator finds the problem.

23. Another problem has been the migration of carbon fines from the adsorbers through the post-filter to the recharge wells. These fines have resulted in the plugging of recharge wells and/or the failure of well equipment. The plugging of the recharge wells has been a significant problem since the system as a whole lacks sufficient recharge capacity and proper distribution. Some of the recharge wells were constructed and screened in areas of low permeability. The recharge capacities of all the wells tend to decrease with time. Some of this capacity can be regained through periodic cleaning of each well. This lack of sufficient recharge capacity has resulted in the frequent requirement to surface discharge to the bog, the effluent from the treatment plant in order to treat the quantity of water produced by the

dewatering wells. As a result, insufficient water has been recharged along the length of barrier to maintain the water table on the downgradient side of the barrier at a level comparable to the upgradient side. On occasion, this difference in head has approached 5 ft which could provide a significant potential for flow through or under the barrier.

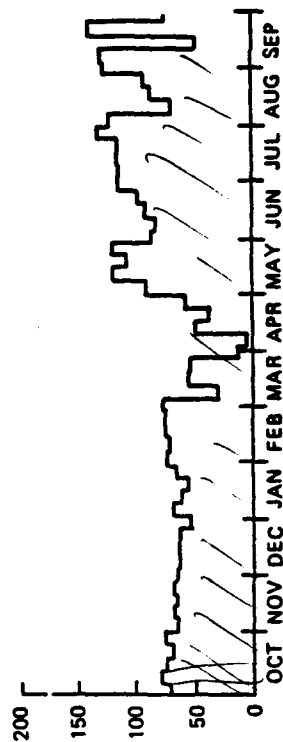
24. This situation has probably been aggravated by flooding of the system on several occasions due to large storm events. The system was severely flooded in late April 1984 and again to a lesser degree in June and August. During a large storm event, First Creek overflows into the area of the system primarily because of an inadequately sized culvert under 96th Avenue. The eastern end of the system was inundated and water surrounded the well heads. The flood in late April reached the bog and eroded a portion of the dike on the north side of the bog.

System Flow Quantities

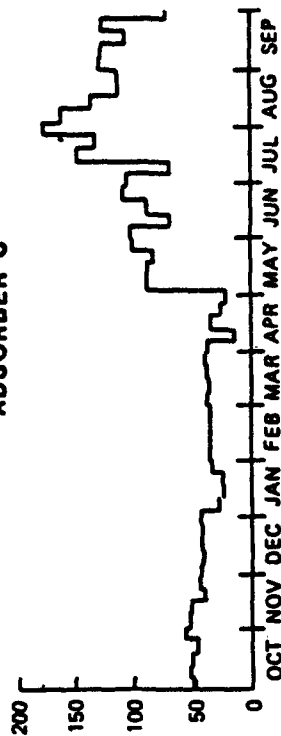
25. The quantity of flow through the treatment system is recorded on a weekly basis. The flow quantities recorded between October 1983 and October 1984 are presented in tabular form in Appendix C. The table in Appendix C includes weekly, quarterly, and annual flow through each adsorber along with the total flow. Graphical presentations of the weekly data have been prepared and are presented in Figure 5. As indicated, the flow through the adsorbers was fairly constant until March 1984 and averaged a total of 150 gpm. Total flow decreased during March, increased some in April, and increased significantly in May. During the summer, total flow ranged from 250 to 400 gpm.

26. Although the total flow through the plant should reflect the flow of ground water approaching the barrier, this was not the case over the study period. The flow quantities reflect the capacity of the system over the year to either pump, treat, or recharge water. Flow during the winter months was limited due to frozen equipment and lack of recharge efficiency. During the spring and summer, equipment was repaired and treated water was surface discharged to the bog resulting in an increased system capacity. In general, the weekly fluctuations in flows can be attributed to variations in system capacity due to the operability or inoperability of certain equipment or system components.

ADSORBER B



ADSORBER C



ADSORBER A



TOTAL TREATED

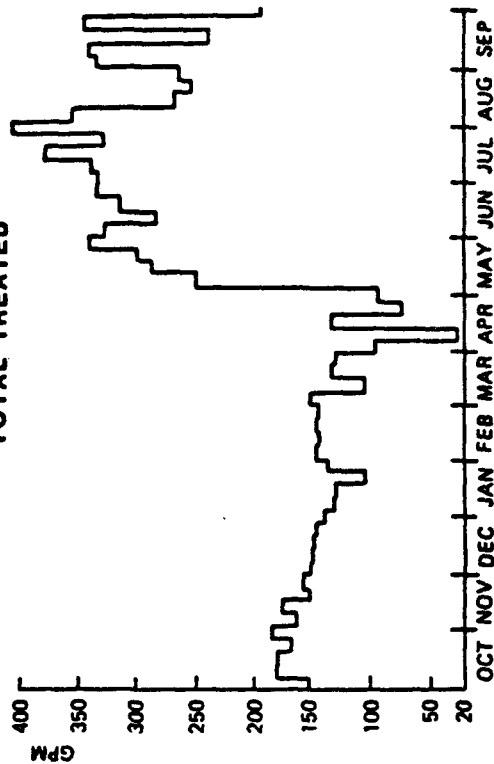


Figure 5. Water treated by adsorbers A, B, C, and total treated water flow

FY 84

System Influent and Effluent Water Quality

27. The quality of the influent to and the effluent from the treatment system is monitored by periodically taking grab samples and analyzing them for the contaminants of concern. Influent samples are collected from each of the three individual adsorber treatment trains in order to determine the quality of water flowing to each adsorber. The samples are collected from sampling ports located in each train between the prefilters and the adsorbers. A single effluent sample is collected from a sampling port located downstream from the postfilters. The samples are collected in glass containers, sealed, and immediately transported to the Analytical System Branch for analysis.

28. The results of these analyses for the period January 1983 through October 1984 are presented in tabular form in Appendix D. The table includes concentrations found for eight organic compounds of concern along with chloride, fluoride, TOC, and pH. Graphical presentations of the concentrations found for DBCP, DIMP, DCPD, combined organo-sulfurs, chloride, and fluoride over the period October 1983 to October 1984 have been prepared and are presented in Figures 6 through 11. The three influent concentrations and the effluent concentration for each parameter during each sampling period are included in the associated figure. Darkened line sections on the figures indicate concentrations below the respective reportable levels.

29. Under the original operating scenario, each of the three wetwells were to feed an individual adsorber. Thus, the influent to each adsorber would contain a higher concentration of a particular contaminant than would the others since the contaminants are not evenly distributed along the barrier. The results of this type of operation are evident in the figures for the period October 1983 through April 1984. For example, Figure 7 indicates that during this period, the highest DIMP concentration was consistently found in the influent to adsorber A while essentially no DIMP was found in the influent to adsorber C. Starting in May 1984, operational problems resulted in a requirement to distribute water from individual wetwells to more than one adsorber. The major fluctuations in the concentrations of contaminants shown in the figures for the period after May 1984 are the results of these operational changes.

30. DBCP. The highest concentrations of DBCP (Figure 6), approximately 5 to 6 ppb, were found in the influent to adsorber B. DBCP was also found in

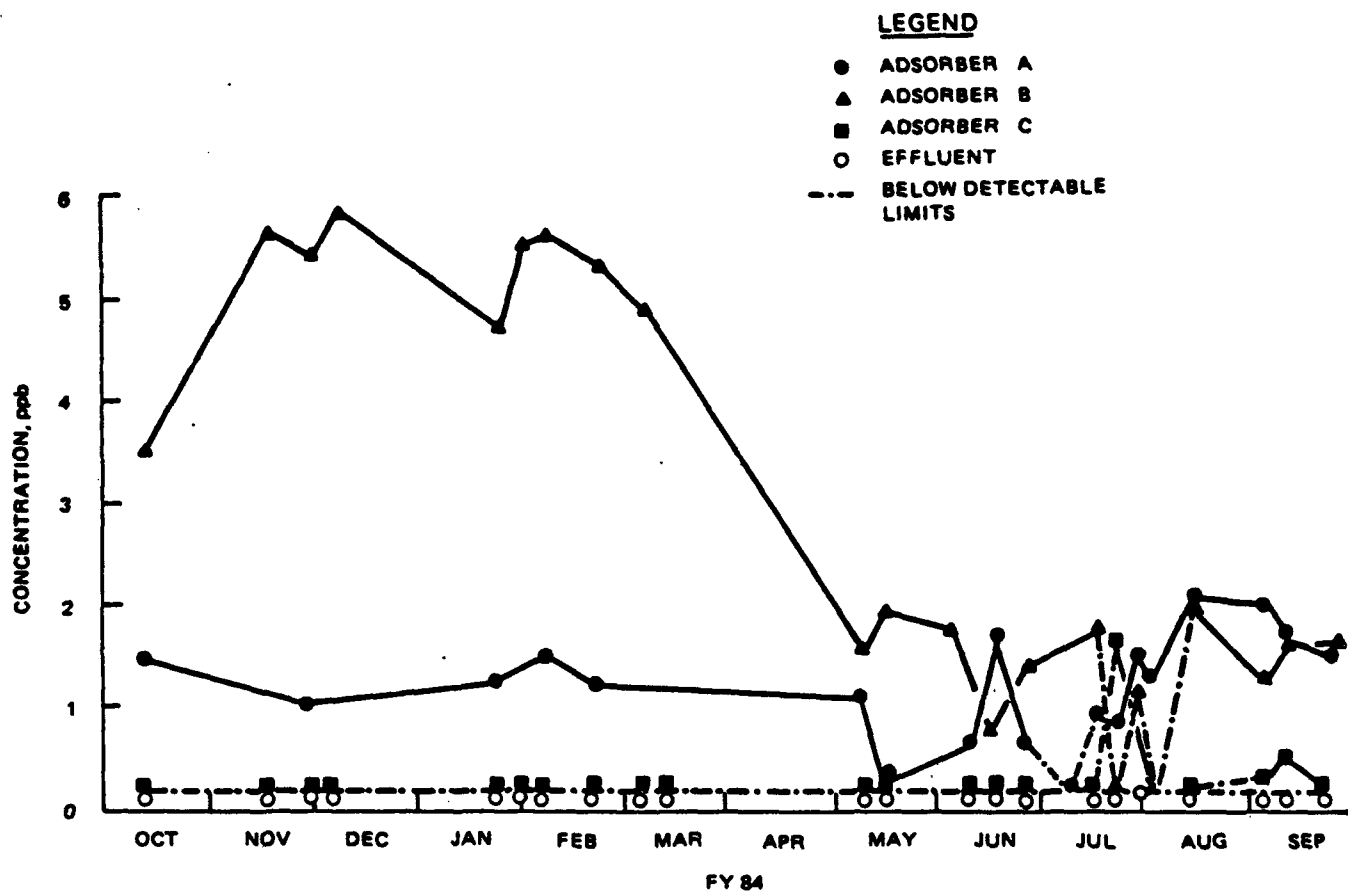


Figure 6. Concentration of DBCP in influent and effluent

the influent to adsorber A but at much lower concentrations. Essentially no DBCP was found in the influent to adsorber C prior to May 1984 when the water from the individual wetwells was mixed. The concentration of DBCP in the effluent was consistently below the reportable level of 0.2 ppb.

31. DIMP. The highest DIMP concentrations (Figure 7), approximately 550 to 700 ppb, were found in the influent to adsorber A. DIMP was found in the influent to adsorber B prior to May 1984 in the range from 150 to 300 ppb. Essentially no DIMP was found in the influent to adsorber C prior to May 1984 as previously mentioned. The concentration of DIMP in the effluent was generally less than 50 ppb.

32. DCPD. The highest concentrations of DCPD (Figure 8) were found in the influent to adsorber A. These concentrations ranged between 500 and 700 ppb prior to May 1984 except in December 1983 when a concentration in excess of 1100 ppb was found. Much lower concentrations were found in the influent to adsorber B while essentially no DCPD was found in the influent to adsorber C. The concentration of DCPD in the effluent was generally less than 10 ppb except for a couple of sampling periods when concentrations around 50 ppb were found.

33. Combined organo-sulfurs. The highest combined concentrations of organo-sulfurs (Figure 9), approximately 120 to 150 ppb, were found in the influent to adsorber B. Somewhat lower concentrations were found in the influent to adsorber A. Essentially no organo-sulfurs concentrations above the detection level were found in the influent to adsorber C or the effluent from the plant.

34. Chloride. Chloride is a contaminant that is not removed by the activated carbon treatment system. Therefore, the total mass of chloride in the three influent streams should equal the total mass in the effluent stream. Thus, the concentration of chloride in the effluent is a flow-weighted average of the concentrations in the influent streams. The significant changes in concentrations evident for the organic contaminants during May 1984 (Figure 10) are somewhat masked in the chloride concentration graph because of a lack of data for that time period. The highest chloride concentrations, in excess of 400 ppm, were found in the influent to adsorber A. The concentrations found in the influent to adsorbers B and C varied between 100 and 200 ppm except for

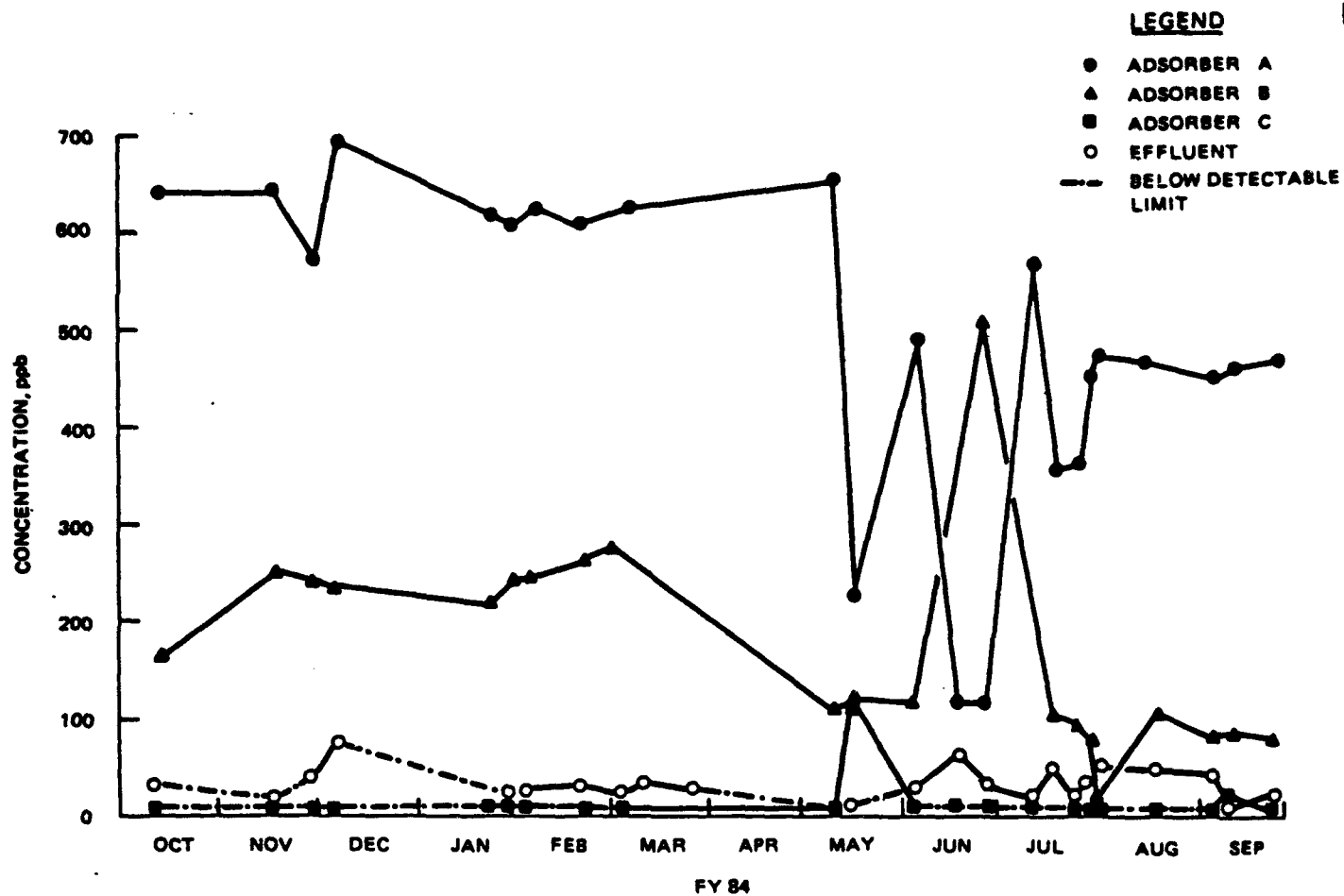


Figure 7. Concentration of DIMP in influent and effluent

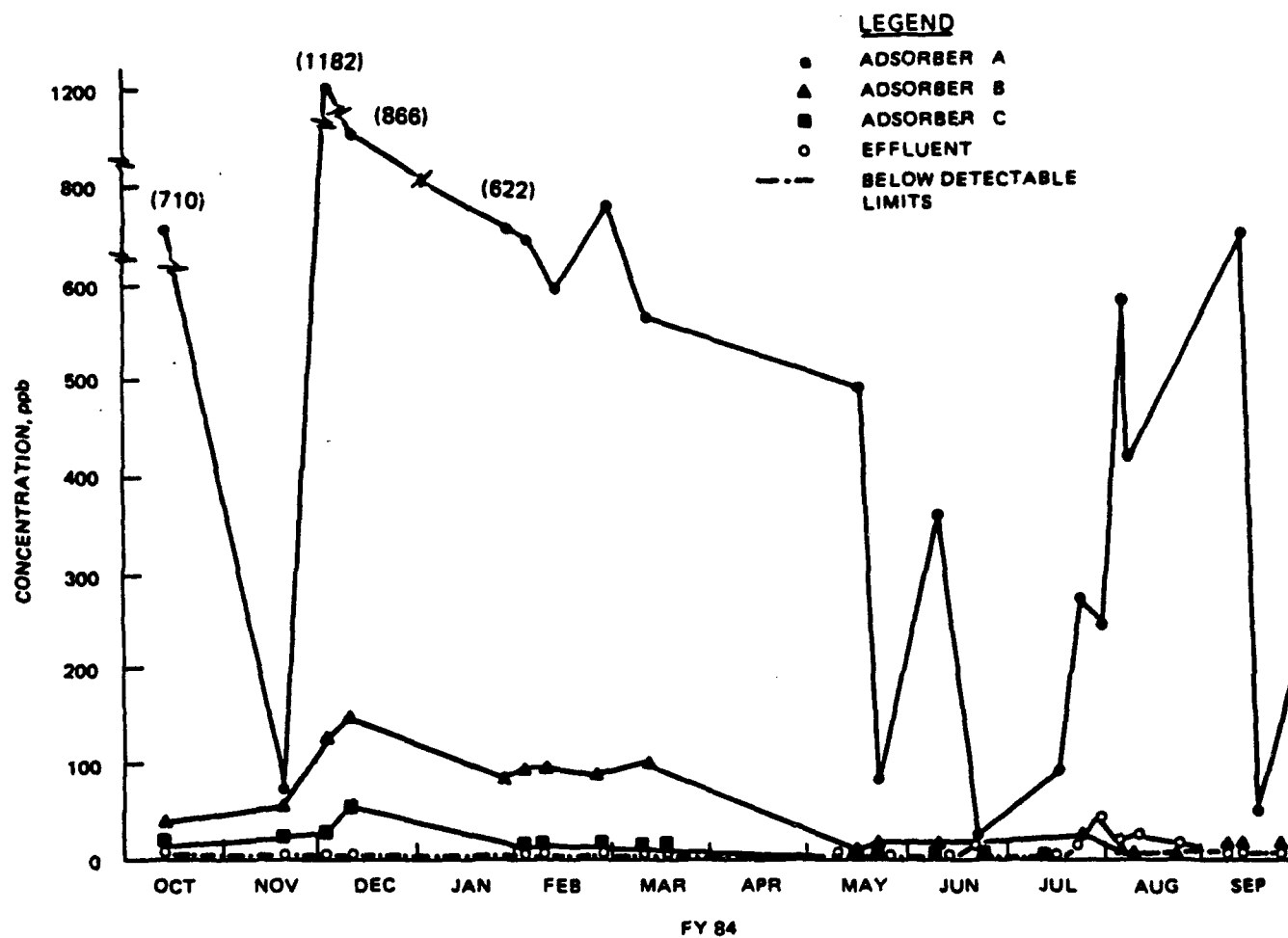


Figure 8. Concentration of DCPD in influent and effluent

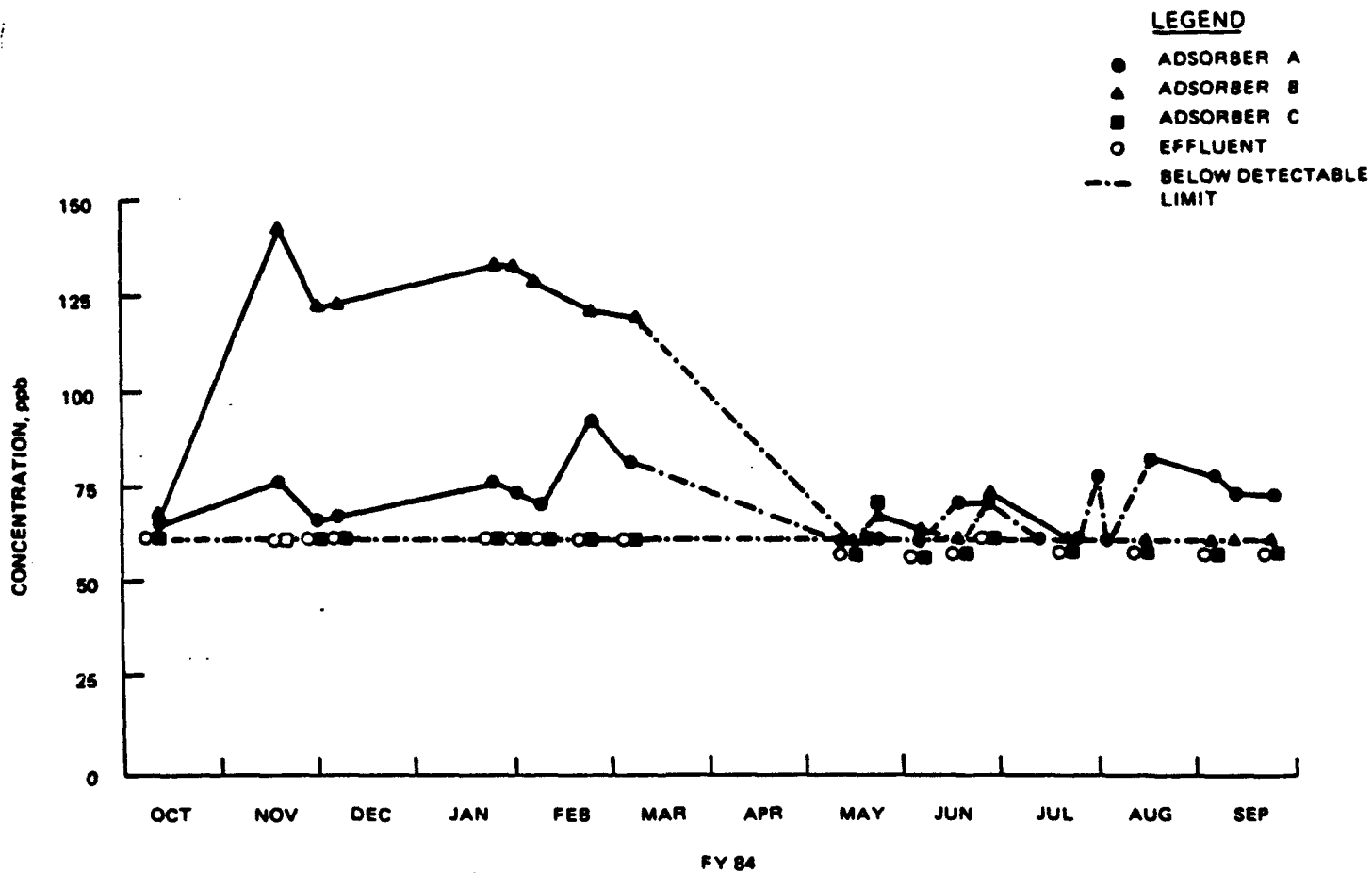


Figure 9. Concentration of Combined Organo-Sulfur in influent and effluent

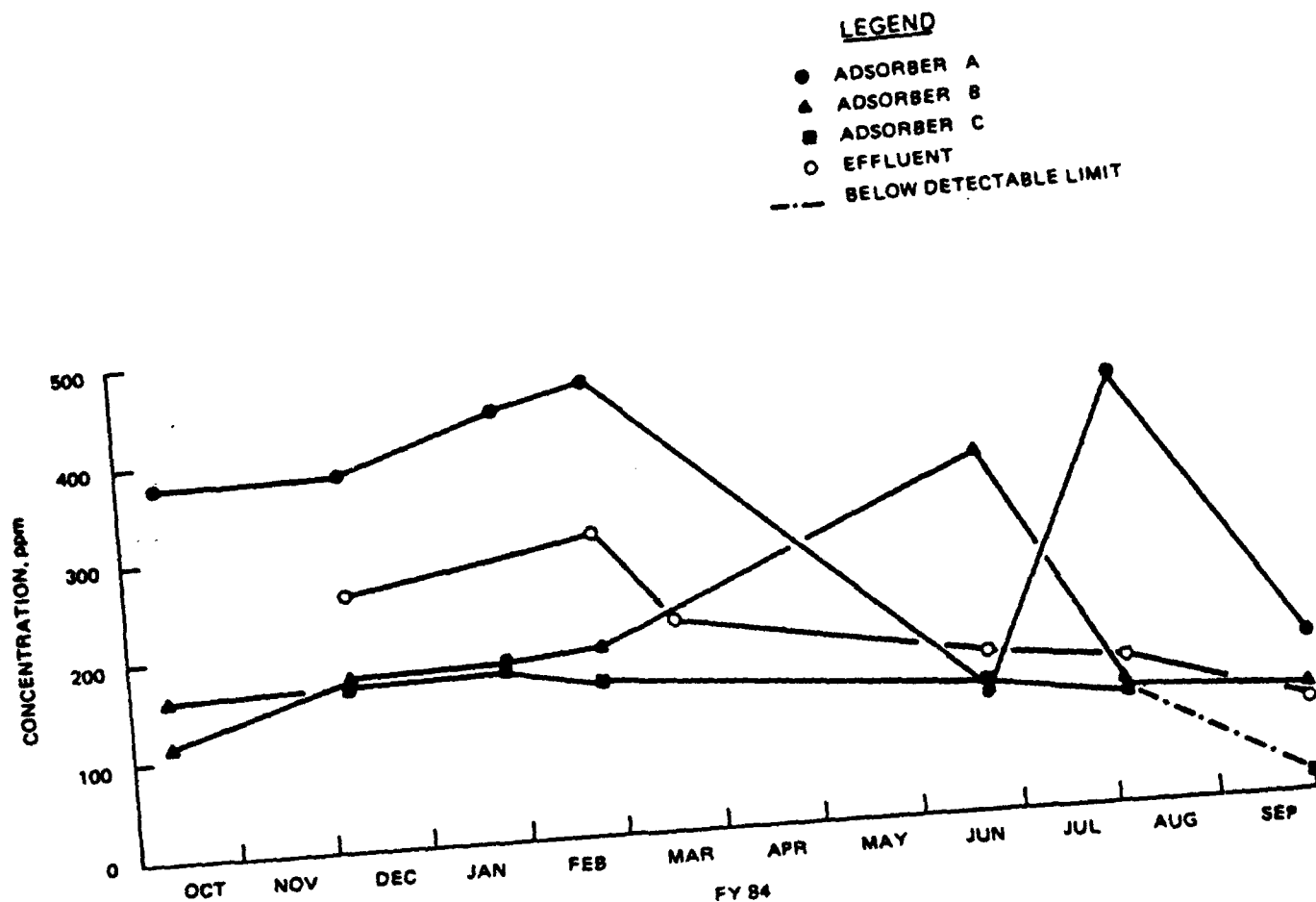


Figure 10. Concentration of Chloride in influent and effluent

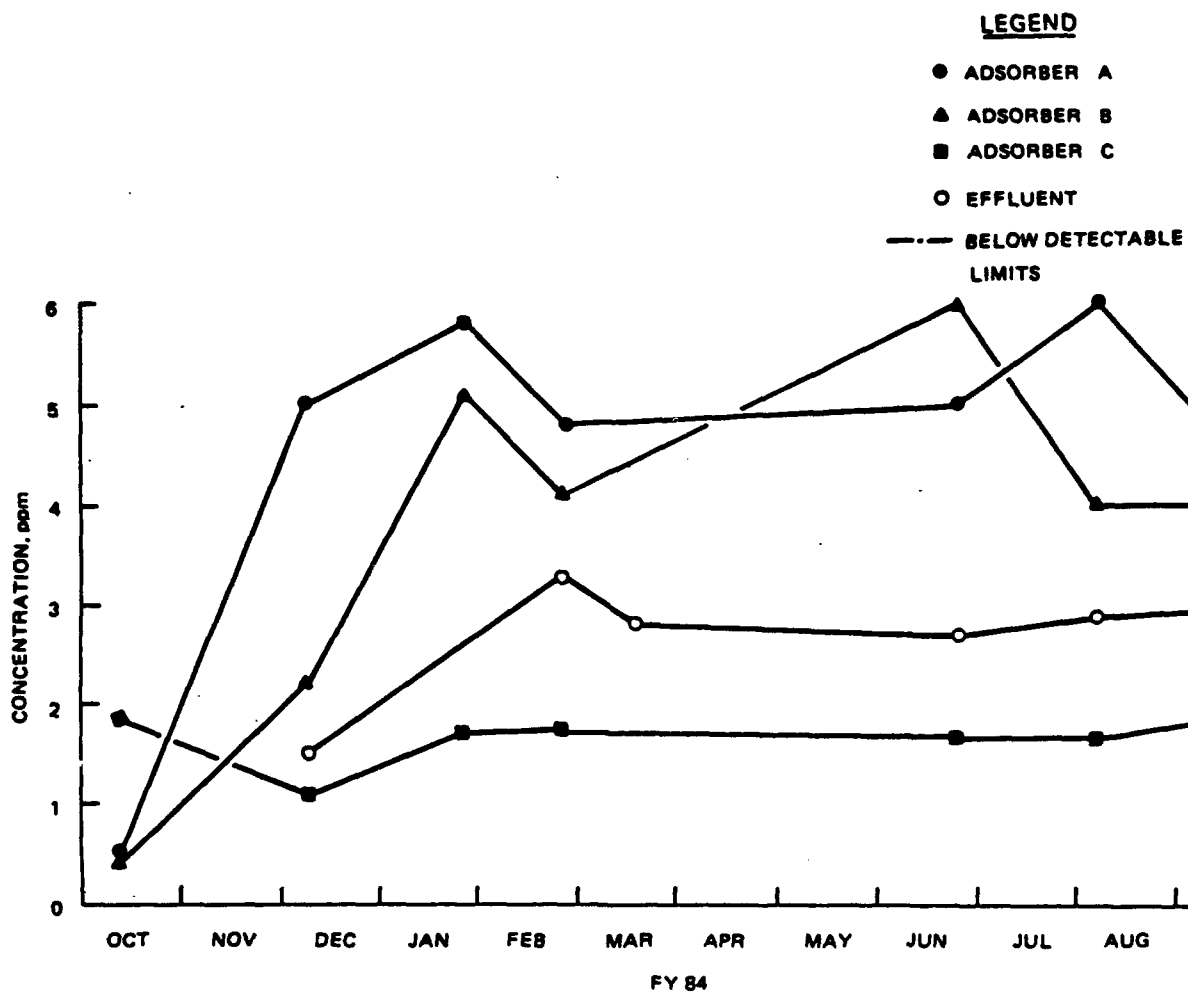


Figure 11. Concentration of Fluoride in influent and effluent

the period when the water from the individual wetwells was mixed. The concentration of chloride in the effluent peaked during February 1984 at approximately 300 ppm and then steadily decreased to approximately 100 ppm by the end of the study period.

35. Fluoride. Fluoride, like chloride, is not removed by the activated carbon treatment system and therefore the concentration in the effluent is a flow-weighted average of the concentrations in the influent streams. The highest fluoride concentrations (Figure 11), ranging from 4 to 6 ppm, were found in the influents to adsorbers A and B. The concentration in the influent to adsorber C ranged from 1 to 2 ppm while the concentration in the effluent was generally around 3 ppm.

PART IV: DATA EVALUATION

Geology and Hydrogeology

Geologic Parameters

36. The flow of alluvial ground water is controlled by the paleodrainage that was developed on the subcrop of the underlying Denver Formation. A contour map of the Denver surface is presented in Plate G-1. A significant paleodrainage feature defined by contours on the map is an apparent buried river valley that enters the North Boundary area from the southwest corner and crosses the boundary centered about 500 feet east of the "D" Street intersection. The northwest end of Basin F overlies the river valley in the southwest corner of this area. The slurry wall was constructed across this buried valley. The valley has a maximum width of 4000 feet and is bordered by paralleling Denver highs on each side. A large portion of the valley surface is relatively flat and slopes in elevation from about 5148 feet MSL at the northern end of Basin F to 5130 feet MSL near the north boundary. A deeper channel, incised approximately 15 feet lower in the Denver than the average valley floor, extends beneath the northwest end of Basin F toward the east end of the Pilot barrier wall location. The deeper channel is narrow near Basin F, gradually widens toward the north, and intercepts paleodrainage from the North Plants and First Creek areas at points near the east end of the Barrier wall. In effect all Denver surface drainage, from west of Basin F to east of First Creek is funneled across the north boundary of RMA through the old river valley where the barrier was constructed. Although alluviation and subsequent erosional processes have largely obscured the present surface expression of the buried river valley, the surface drainage is similar in flow direction to the underlying paleodrainage. The buried river valley alignment is well defined by the geometry of ground-water contours seen in Plates WL-1 thru WL-5.

37. Alluvial deposits that have filled the valley consist largely of silts, sands, and gravels, with average thicknesses ranging from 35 to 40 feet in the area of Basin F to 20 to 25 feet near the north boundary. Ground water flows readily through the alluvial deposits and provides the primary conduit for ground water contaminants from the Basin F area which migrate toward the north boundary of RMA. All of the major chemical plumes are aligned within

the buried valley limits. The plumes for most chemicals, both pre and post containment system, flow northeast from the Basin F area aligned with, but not necessarily directly over the deeper channel in the valley. Halfway between Basin F and the north boundary, the plumes turn more northerly and flow toward the area of the Pilot System. The plumes show no tendency to follow the deeper channel toward the east end of the containment system. The rather abrupt change in plume alignments suggest a change in ground-water flow direction within the old river valley. There are at least two possibilities that are influencing the change in flow direction, or a combination of both. One possibility is that the southeast valley wall in this area is in contact with a Denver sand channel that is strongly recharging the alluvial aquifer. The steep water gradients along the deeper channel are characteristic of an area where water is entering the alluvial channel from low permeability Denver silty sandy zones. Further to the northeast the gradients are not as steep where water is believed to be exiting the Denver through more permeable sand zones. The effect of the Denver Formation input is similar to a tributary entering a main stream. The other possibility could be related to the influx of large quantities of alluvial ground water from First Creek.

Subsurface Geology

38. Eleven geologic cross-sections were constructed in the area of the North Boundary Containment System. Four of the cross-sections run parallel to the Containment System alignment. The other seven cross-sections run perpendicular to the system alignment. A plan of the cross-sections is presented as Plate G-2.

39. The alluvium deposits shown on all the cross-sections generally represent an upward fining sequence of basal gravelly sands and upper silts and clays. This general stratigraphic sequence has been complicated by secondary cut and fill processes of migrating streams back and forth across the alluvial deposits. As a result of the cut and fill processes, many of the alluvial lithologic boundaries along the cross-sections are conformed to the geometry of former stream channels. In several areas, the channels have cut entirely through the basal gravels and have back filled with clays, clayey sands, and silts on top of the underlying Denver Formation. The cross-sections reveal that lateral changes from gravelly sands to clayey sand or sand to clay, etc., are common occurrences and have no predictable sequence.

Cross-Section A-A' (Plate G-3)

40. Cross-Section A-A' extends through the alignment of alluvial withdrawal wells. The wells were extended about five feet into the Denver Formation. Boring 330, at the west end of the system, shows Denver sand in contact with alluvium. The remaining borings lying west of D Street show alluvium in contact with clay shale. Borings in the area east of D Street show alluvium in contact with siltstone. Near the east end of the system boring 327 encountered sandstone beneath the alluvium.

41. The well screens for most of the withdrawal wells are set in gravelly sands near the base of the alluvium. Considering the coarseness of the deposits, the wells should function properly. However, many of the well field logs indicate the gravelly sands are cemented or partially cemented with secondary calcium deposits. If the cementation is wide spread in the screened intervals, the permeabilities may be very low, reducing the individual well output capabilities. Well screens set in borings 332, 334, 316, 317, 318 and 328 are located in channels filled with clay or clayey sand. The pump rates for these withdrawal wells should be low.

Cross-Section B-B' (Plate G-4)

42. Cross-Section B-B' extends along the center line of the barrier wall. The borings along the section extend to an average depth of about 50 feet into the underlying Denver Formation. The base line of the barrier wall is included on the cross-section to emphasize the areas that have geological or hydrogeological potential for ground-water movement under the barrier.

43. There are major sand and sandy silt channels and lenses within the Denver Formation that are lying above and below the base of the barrier. The Denver sands are isolated locally by intervals of clay shale or sandy clay shale. The base of the barrier is generally located in clay shale zones lying between the sands. However, in several areas as shown on the cross-section, the base of the barrier is in contact or very close to some of the Denver sand zones. Denver sand channels and lenses that are subcropping in the alluvium appear to have been effectively truncated and blocked by the barrier wall along Section B-B'.

44. In the areas where Denver sands are interconnected with the base of the barrier wall and the alluvial sands and gravels, there is a potential for

movement of ground water under the barrier. The most favorable conditions conducive to leakage of ground water are found in the area underlying the Pilot site.

45. The base of the barrier wall at the Pilot site is 13 to 18 feet higher in elevation than the highest and lowest points of the base of the barrier along the Primary system east of the Pilot site. Near the west end of the Pilot site, the base of the barrier appears not to extend into the Denver. A major Denver sand channel approximately 18 feet thick underlies a large part of the Pilot site. The top of the sand channel is only six feet below the alluvial contact and about the same depth below the barrier. A five foot thick sandy siltstone lense lies just below the base of the barrier at the east end of the Pilot site.

46. The differential in ground-water levels on opposite sides of the barrier wall, especially when water levels are high behind the barrier east of the Pilot site, furnishes the driving force for ground water to move under the area of the Pilot site.

Cross-Section C-C' (Plate G-5)

47. Cross-Section C-C' extends through the alignment of alluvial recharge wells. The wells were generally extended about five feet into the underlying Denver Formation. The wells lying west of the Pilot site have screens that are placed either totally or partially in alluvial clay. Well 434 was extended about 15 feet into alternating clay shale and sand lenses of the Denver Formation. The well screen for 434 is mostly in the Denver. Well 433 revealed clay shale and sand lenses in the underlying Denver. The remaining wells west of the Pilot site show Denver clay shale in contact with the alluvium. The well screen in 435 is located partially in a sand lense and partially in underlying clay. The well screens in 437 and 438 each bracket a sand lense that connects between the two borings.

48. Boring logs were not available for the recharge wells (401 through 412) that were put in for the Pilot system. In the area east of the Pilot site, Wells 413 through 420 show the Denver contact is with clay shale, 421 is in sandstone, and with the exception of 426, which is in clay stone, Wells 422 through 431 show alluvium is in contact with siltstone. The well screens in

418 through 421 are located in a clay filled channel with a thin interconnecting sand lense that is bracketed by each of the screens. The remaining recharge well screens in borings east of the Pilot site are located either totally or partially in the basal alluvial gravelly sands.

Cross-Section D-D' (Plate G-6)

49. Cross-Section D-D' extends through a row of monitoring wells lying just to the north of the recharge wells. The screens for wells 23196 and 23048 are totally in clay. The screen for well 24006 is totally in clayey sand. The remaining screens are in sand or gravelly sand.

Cross-Sections E-E' through K-K' (Plates G-7 and G-8)

50. Cross-Sections E-E' through K-K' are spaced at selected intervals along the Containment System alignment to show representative geologic relationships in a direction perpendicular to the barrier alignment. These sections include borings that are shown on the previous sections, A-A' through D-D'. The alluvial sand and clay zones are defined in detail, however deeper boring data that would allow North-South projections of the Denver sands under the barrier are unavailable for most of the Containment area.

Hydrology

Historical Impacts

51. Monitoring of the ground-water hydrology for the North Boundary has been extensive since 1978 when the pilot containment system was placed into operation. Prior to this the area was investigated to gather geologic and hydrologic data and to determine the types and extent of ground-water contamination for the design of the Pilot System. The results of many of these studies have been published in reports at RMA.

52. The hydrology of the North Boundary area has been influenced by a number of actions or events associated with both the operations of RMA and nature. Because First Creek transects the North Boundary area, there are interactions between the surface-water hydrology and the ground-water hydrology. This interaction is very dependent upon storm events and ground-water movements. The documentation of storm events was not conducted prior to 1983. Observation of ground-water and surface site conditions prior to and after a storm event substantiate the interaction. The impact of floods which occurred in April, June and August of 1984 has been discussed previously in Part III.

53. One influence on the ground-water hydrology at the North Boundary has been the result of RMA operations or actions. The use of Basin "C" as a surface water recharge facility created an influx of ground water to the North Boundary. This action was conducted routinely during the late 1960's and resulted in high ground-water levels north of Basin "F" and ultimately along the RMA north boundary in the early 1970's. These conditions moved contamination towards the boundary and also created a surface water problem. The existence of the surface water at the bog which contained numerous contaminants contributed to the issuance of the cease and desist order from the Colorado Department of Health in 1975.

54. Other factors that have contributed and impacted the ground-water system have been the operation of the Sewage Treatment Facility, numerous pump tests, pumping and irrigating in sections 23 and 24, and operation and testing of the Pilot Containment System. Since the construction of the Expanded North Boundary System, the operations of the facility have created various impacts of the ground-water hydrology. The mounding of ground water that occurred when the system was not fully operational caused high water levels behind the barrier and surface water flow along the eastern areas near First Creek. Initiation of improved system operations resulted in higher productivity of the dewatering wells, but a lack of recharge capacity forced the use of the bog as a recharge component. Recharge to the bog caused the water level to rise in the vicinity of the bog.

55. The water table gradient across the barrier from dewatering wells to recharge wells has been fairly steep. This condition is primarily caused by the difficulty in dewatering and also by the lack of recharge capability. Recharging the alluvial aquifer with treated water on the western section has not been consistent. The use of the bog has recharged the water in an isolated area along the system and even this area has not demonstrated a reverse gradient across the barrier that is desired.

Water Levels

56. Ground-water table contour maps of the study area were made for the 1979, 1983 and February, May, August 1984 time periods (Plates WL-1 thru WL-5). Data points were insufficient to construct a meaningful ground-water map for the 1977 period. The ground-water maps indicate that the ground-water flow

pattern conforms largely to the paleotopographic surface of the Denver Formation. The water table gradients are flat in the buried river valley and steep along the valley walls. The combined ground-water flow potential causes water to flow across the north boundary of RMA through the area where the Pilot and Final barriers were constructed.

57. The 1979 water table map (Plate WL-1) indicates the Pilot barrier had effectively altered the flow of alluvial ground water through the Pilot site. The map shows a shallow depression has developed behind the Pilot barrier, caused by the pumping of wells associated with the system operations. Ground water at this time had free access to flow around the Pilot barrier on either side. After the expanded barrier was constructed on both sides of the Pilot barrier, the free flow of alluvial ground water across the north boundary was blocked.

58. The ground-water map for 1983 (Plate WL-2) presents some of the effects produced by the combined barrier systems on ground-water flow. The 1983 map shows ground-water levels have risen since 1979 behind the expanded barrier east of the Pilot site. For the same time intervals, the water levels remain about the same or slightly lower on the west side of the Pilot site. In contrast, the ground-water level behind the Pilot barrier section has dropped during the same period. The relationships of changes in water levels to normal aquifer fluctuations, containment system operations, etc., between 1979 and 1983 are not known from the data that were available.

59. The 1983 ground-water map shows a drop in ground-water level, a decrease in the ground water flow gradient and a geometry of flow that tends to demonstrate this action. Drawing an absolute conclusion is difficult in light of the unknowns in the operation of the system. Several ground-water maps prepared during various periods all show anomalous gradients in the area of the pilot treatment system. The increased ground-water head on the eastern portion of the system could force ground-water through an easier conduit in the underlying Denver Formation that was not sealed by the Pilot barrier construction. The relationship between the base of the barrier wall and the Denver stratigraphy was previously discussed under the heading of Subsurface Geology.

60. The February 1984 water level map (Plate WL-3) shows water levels along the western end of the barrier at approximately the same levels as February 1983. Mounding of ground water occurs over areas where the Denver

surface is high such as the eastern part of Section 23. The steep gradients shown in the southwest portion of Section 24 indicate areas where water is moving through less permeable Denver sand zones. Toward the center of Section 24 the contours are spaced further apart indicating faster flow. The area of faster flow is where the significant contaminant plumes make an abrupt turn toward the northwest. The water table contours apparently are reflecting differential flow from the Denver into the alluvium.

61. The May 1984 map (Plate WL-4) shows very little change from the February 1984 map. The water levels near the center of Section 24 were slightly higher but no significant changes are apparent. Water level contours are closely spaced east of the center of the system indicating a buildup of water against the barrier. Flatter gradients toward the barrier occur west of D Street and in the First Creek area. The August-September 1984 map (Plate WL-5) showed the results of higher pumping rates along the eastern and central portion of the control system. The effect of this pumping was to change the water table gradients near the barrier. The gradients show that ground water moving toward the barrier flowed to the east toward the pumping wells used in the vicinity of First Creek.

Distribution of Contaminants

62. Ground-water contamination at the North Boundary can be associated with a number of operations and time periods at RMA. Historical contamination at the North Boundary was probably associated with disposal operations in the Basin A area. Some contamination from this area appears to still be migrating out of the area, northwest under Basin F, and north to the boundary. More recent contamination can be associated with Basin F, the sewage treatment plant, and the chemical and sanitary sewers (Figure 12). Contaminants from these sources enter the ground water and are transported through the relatively permeable alluvial aquifer towards the North Boundary. The contaminants identified at the North Boundary are associated with various activities conducted by various organizations on the Arsenal. Their distributions and concentrations along the boundary reflect different manufacturing or generation periods, disposal practices, and migration characteristics. In order to illustrate the changing distribution of the contaminants along the North Boundary both historically and during the study period, a series of isoconcentrations maps have

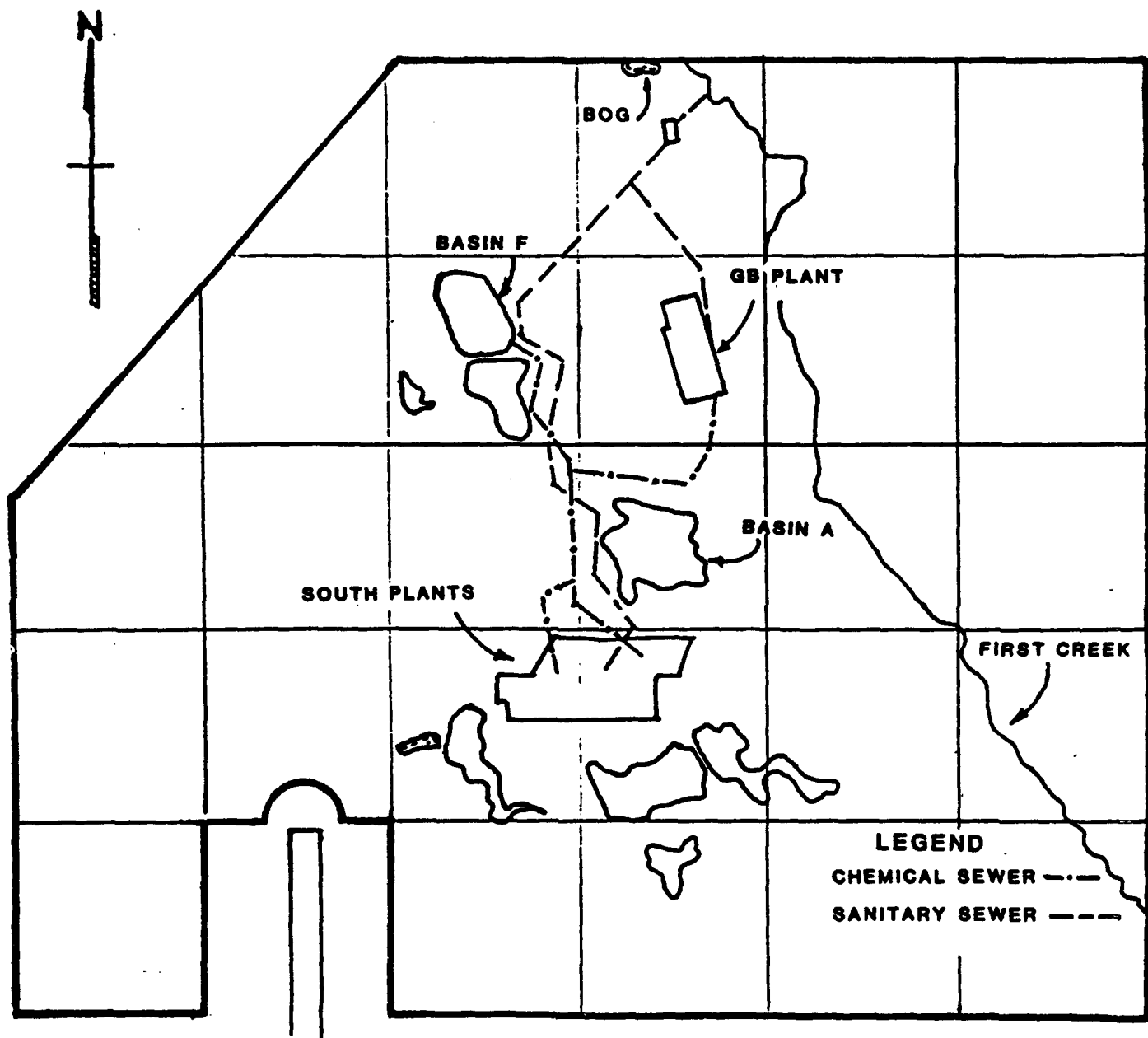


Figure 12. Location of chemical and sanitary sewers at Rocky Mountain Arsenal.

been developed for each of the major contaminants (Plates IC-01 thru IC-47). The historical conditions are presented in individual maps developed using data collected in 1977, 1979, and early 1983. The conditions existing during the study period are presented in individual maps developed using data collected from four separate time periods stretching from late 1983 through 1984. The data collection associated with each individual map is identified on the respective plate.

Chloride

63. Chloride is an inorganic associated with early process operations conducted at RMA. It is a contaminant common to all the waste basins located on RMA and has been analyzed as a ground water contaminant since the mid 1950's. The mobility of chloride contamination corresponds to its high solubility in water and the fairly low reactivity with surface soils and aquifer materials. The long-term existence of the contaminant and its mobility substantiate the widespread occurrence of the contaminant in ground water on the Arsenal, as well as off-post. Chlorides occur naturally and are generally found at a level around 100-150 parts per million (ppm) in alluvial ground water in the vicinity of RMA. Levels of chloride in ground water exceeded 10,000 ppm in the heavily contaminated source areas on RMA in 1983. Levels of 750 ppm to 1,000 ppm are presently found in ground water in limited areas at the boundary with levels higher (approximately 3000 ppm) near Basin "F", one of the likely sources for the contaminant.

64. The chloride isoconcentration maps for the period 1977 through 1984 are shown in Plates IC-01 through IC-07. The maps reveal that all wells sampled for each period contain a certain amount of chloride ranging from 30 ppm to 10,000 ppm. In many cases, different wells were sampled for each period. The analytical data available for the 1977 period provided enough points to map the general chloride migration trends in the area of Basin F, but very little data was available in the north half of the study area. The 1979 and early 1983 data sets provide sufficient points to map chloride concentrations and plume trends in the study area on post. The standardizing of monitoring programs in late 1983 and 1984 resulted in consistent analytical data sets from which contaminant maps were produced. The contours define chloride concentration in values of 100, 250, 500, 1,000, 2,000, 5,000, and 10,000 ppm, depending on the degree of concentration locally.

65. The maps show major chloride contamination is migrating from the Basin F area in two separate directions, one to the northeast and the other is toward the northwest. The chloride migrating to the northwest is flowing out of the study area and will not enter the North Boundary Containment System. The major chloride migration northeast from the Basin F area is following the alignment of the buried river valley towards the North Boundary of RMA. About halfway between Basin F and the North Boundary, this major plume divides into two separate branch plumes, with one branch moving north and the other northwest. The north branch plume extends through the east half of the pilot containment site while the northwest branch plume flows through the area west of the pilot site (See Plate IC-02). The branching of the contaminant plume is less evident in later maps as the north plume has become the predominant feature.

66. In comparing the maps for the various periods, higher concentrations of chloride have migrated further from the Basin F area and closer to the North Boundary for each succeeding period. The 1979 map shows the chloride concentrations along the north and northeast branch plumes are about equal. The early 1983 map shows higher chloride concentrations along the north branch. This trend continued as evidenced by the late 1983 and 1984 maps. The chloride distribution as found in 1979 and early 1983 indicates that high concentrations of chloride were present at the boundary prior to 1977 and that the chloride contaminated ground water is being held up in low permeability aquifers where ground-water velocities are very low. These areas of high chloride concentrations continue to exist on the west side of the system predominantly down gradient of the barrier as evidenced in the late 1984 maps. In spite of the treated water chloride concentrations of around 250 ppm, the problems of recharging the treated water into the tight formations on the west end of the system has prevented the flushing of the residual high chloride contaminated ground water from the area. The ground water downgradient of the system on the east, where recharge capability is greater, reflects the treated water concentrations of 250 ppm. Lower values have been recorded in areas where clean surface water can infiltrate.

Fluoride

67. Fluoride, like chloride, is an inorganic contaminant that is found naturally in the ground water in the vicinity of RMA. The natural levels of

fluoride are likely to be related to the geologic origin of the aquifer materials. The natural levels of fluoride can be quite high, exceeding 4 ppm in many cases. Much of the background water quality data for the North Boundary area indicates that the natural levels are 2 ppm or less. Fluoride is also a contaminant that is associated with several manufacturing processes that have been conducted at RMA. The manufacture of GB agent is the major process whose waste stream contained high concentrations of fluoride. For this reason, fluoride is associated with the operations of all the major basins that have been used for disposal at RMA.

68. The fluoride isoconcentration maps for 1977 through 1984 are shown in Plates IC-08 thru IC-14. Fluoride was found in every well sampled with concentrations ranging from below 1 ppm to over 12 ppm. The map contours are in 1 ppm increments except for several maps in 1984 where 2 ppm intervals were used for maps with high fluoride concentrations. Variations in the sampling programs and sampling sites have created differences in the plume maps.

69. The contaminant maps showing the distribution of fluoride do not indicate a definite source of the fluoride in spite of its widespread association with the waste basins. As noted previously, there is no defined plume or migration trend for fluoride. Generally, high levels are found in low permeability areas and low concentrations are found in the high permeability areas. The areas of high concentration are in the north, northwest part of section 23, west of the pilot containment system site. The lower fluoride concentrations are found in high permeable aquifers located in the southeast part of section 23 and in section 24. The trend of low concentration is quite consistent throughout this area and is dissimilar to other contaminant patterns that have been identified. Concentrations of the other contaminants generally define a plume that originates from a potential source area.

70. A close comparison of the maps indicate very similar trends from 1977 into 1983. An area of lower concentration (< 2 ppm) appears north of Basin F on the 1979 map and again in the late 1983 map. This trend continues on through 1984. The concentrations identified in the second quarter 1984 map along the west end of the system are considerably higher, nearly double the previously mapped levels. However, the same concentration trends continue to apply. The concentrations for the last two 1984 maps have dropped, again without changes in the trends. The late 1984 maps do indicate an enlargement of the low concentration area north of Basin F.

DIMP

71. DIMP (Diisopropylmethylphosphonate) is an organic compound that is associated with RMA operations. DIMP is a contaminant common to all the waste basins located on RMA. DIMP can be found nearly everywhere that contaminated ground water is found on RMA and off-post to the north and northwest. DIMP, like chloride, is quite soluble in water. The levels of DIMP in ground water are found as high as 15,000 parts per billion (ppb) in the heavily contaminated source areas on RMA. The concentrations found in the North Boundary study area range from below detectable, less than 10 ppb, to over 6,000 ppb.

72. The DIMP isoconcentration maps for the period 1977 through 1984 are shown in Plates IC-15 thru IC-21. Concentration contours are in ppb and are spaced in interval values of 500 with the 100 ppb value defining the outer edge of the plume on early maps. The contour intervals of 10, 50, 100, 500, 1,000, and 2,000 ppb have been used on recent maps. The analytical data sets available for developing the maps vary widely in wells that were sampled and the frequency of monitoring. These variances can produce differences in the plume shapes. Where the same wells, or in some cases close by wells, were sampled for each program, the DIMP value relationships were similar. Since late 1983, the monitoring programs have consistently used the same set of monitoring wells.

73. In comparing the DIMP maps that have been developed, it is obvious that all the maps show similar plume migration trends, i.e., the plumes migrate from the northeast sector of the Basin F area and flow in a northeast direction towards the North Boundary. About halfway between Basin F and the boundary, the plume turns more northerly and intercepts the boundary in the area where the pilot containment system was located. A small plume of DIMP is flowing in a northern direction in the south portion of section 24. This plume is most likely coming from the North Plants area. Down gradient of the control system, the concentrations of DIMP show a downward trend due to the system operation. The areas on the western side of the system where recharge capability is limited will probably continue to show elevated concentrations of DIMP until adequate treated water is recharged into the aquifer to flush the DIMP out.

DBCP

74. DBCP (Dibromochloropropane) is a relatively new contaminant in RMA ground-water investigations. DBCP is an organic product that was manufactured

at RMA in the South Plants area. The levels of DBCP found in the ground water range from 0.2 ppb, the Colorado Department of Health drinking water standard, to above 30 ppb.

75. The DBCP isoconcentration maps for the 1979 through 1984 period are shown in Plates IC-22 thru IC-27. A map for the 1977 period was not developed because of a lack of data. The contours on the early maps are in parts per billion and are spaced in interval values of 5 and 10, depending on the degree of DBCP concentration locally. Contours of 1 ppb are used in areas of lower concentration. Contour intervals of 0.2, 0.5, 1.0, 5.0, 10.0, and 15.0 ppb are used on the more recent maps.

76. The DBCP plume approaching the North Boundary originates at the northeast side of Basin F. The plume flows to the northeast and is closely aligned with the deep channel that runs from north of Basin "F" towards the North Boundary. The plume is parallel to the DIMP plume, but lies a few hundred feet further to the east. Halfway between Basin F and the North Boundary, the plume turns north (as does the DIMP plume) and flows towards the boundary where it intersects east of the pilot system site. The highest concentration of DBCP, 44.6 ppb, was found in well 24008 in 1979. Other wells sampled at this same time showed values in excess of 30 ppb both at the boundary and upgradient of the barrier system. The 1979 plume map indicated a spreading of the plume eastward between the boundary and the STP. This trend is not identified on either of the 1983 maps, but reappears on the 1984 plume maps.

77. In comparing the maps, it is evident that the highest concentrations of DBCP have decreased through time. The highest concentrations in late 1984 were about 15 ppb as compared to levels of 30 or 40 ppb identified in 1979. Presently, the concentrations immediately down gradient of the system are below detectable limits (less than 0.2 ppb) with the exception of well 23043, which is immediately north of the treatment plant and an off post well number 37309, which is located approximately a third of a mile north of RMA adjacent to Peoria Street. The low values found in 37309 are most likely the remnants of the DBCP plume identified by studies conducted between 1979 and 1983.

DCPD

78. DCPD (Dicyclopentadiene) is an organic compound that was used in the manufacturing of several products associated with the South Plants area

operations. The waste streams from these manufacturing processes were in general disposed of in Basin F. However, the existence of DCPD in Basin F liquid has not been demonstrated. The contaminant has also been identified in the ground water in the South Plants area and between Basin F and the north boundary. Confirmation of a single source for DCPD has not been possible, however, the continuity of the contaminant plume would indicate that a source continues to exist.

79. DCPD is a very volatile compound with an odor threshold around 10 ppb. Because of its volatile nature, the sample collection and analysis for the compound is difficult, especially as the concentrations decrease to detectable limits. The early studies that were conducted in 1977 through 1979 resulted in data that was used to construct the early DCPD maps shown in Plates IC-28 and IC-29. A data gap for DCPD exists in the early 1980's. The analysis for DCPD was resumed and maps for 1984 were constructed and are shown in Plates IC-30 thru IC-32. Concentration contour intervals of 500 ppb are used on the maps with the addition of 10 and 100 ppb intervals where necessary.

80. A comparison of the DCPD maps indicate a contamination plume very similar in appearance and alignment to the DIMP and DBCP plume moving towards the north boundary. The early maps show high concentrations of DCPD existing near "D" Street at the east end of the pilot containment system site. Levels in 1977 ranged from 2,500 to 3,000 ppb. The DCPD concentrations in wells sampled upgradient of the boundary towards Basin F show a substantial drop by 1979. This declining trend continues to appear in the 1984 data.

Sulfur Compounds

81. The sulfur compounds identified at the north boundary consist of three different forms: p-chlorophenylmethanethiol, sulfone, and sulfoxide. The compounds are associated with production operations conducted in the South Plants area. Disposal of waste streams from these operations included the use of Basin F, a likely source of the contaminant in the North Boundary area. The concentrations of these three compounds have been added together and used to produce the isoconcentration maps shown in Plates IC-33 thru IC-35.

82. A concentration contour interval of 50 ppb has been used to develop the plume maps. The plumes on each of the maps are very similar and also to the plumes of other contaminants. The data sets did not contain analytical

data along the southern end of the study area and therefore the location of the plumes near Basin F could not be defined. The distribution of the plumes follows a northeastward path parallel to the alluvial buried river valley. As with the other plumes, the path turns northward as it approached the boundary system where it intercepts the dewatering wells on either side of "D" Street. Some low concentrations of sulfur compounds have been identified off post.

Chlorinated Pesticides

83. The chlorinated pesticides aldrin, dieldrin, and endrin were produced in the South Plants area starting in the early 1950's. Production of some of these pesticides continued until the early 1970's. Wastes from the production processes were disposed of in Basin A and Basin F. Some of these pesticides have apparently migrated out of the basins into the ground water.

84. The chlorinated pesticide data presented in this report were obtained from the analysis of ground water samples collected from numerous monitoring wells located between Basin F and the north boundary on the Arsenal and from a few off post wells north of the Arsenal. The samples were collected during four distinct periods of time. The first period was from July through December 1983; the second period was from March through April 1984; the third period was from July through August 1984; and the fourth period covered October 1984. Isoconcentration maps were prepared for each pesticide for each sampling period. These maps which illustrate the distribution of aldrin, dieldrin, and endrin are presented as Plates IC-36 thru IC-47.

85. Aldrin - The distribution of aldrin varied significantly between sampling periods (Plates IC-36 thru IC-39). During the first period, the area of highest aldrin concentrations stretched northeast from "9th" Avenue, just north of Basin F, across "D" Street. Concentrations of aldrin were also found in wells north of the Arsenal during this period. During the second period, the area of highest aldrin concentration was located in the southeast corner of Section 23. The concentration north of the Arsenal had decreased to below the detectable limit. During the third and fourth periods, only isolated areas were identified on the Arsenal with aldrin concentrations above the detectable limit. One area was along "D" Street midway between "9th" Avenue and the boundary. Another area was along "9th" Avenue in the corner of Sections 23 and 24. A final area was identified along the western end of the

North Boundary Control System. No concentrations of aldrin above the detectable limit were found in the off post wells north of the Arsenal during the third and fourth periods.

86. Dieldrin - The analytical data indicate a distribution of dieldrin extending from just northeast of Basin F to the North Boundary System (Plates IC-40 thru IC-43). A clearly defined plume was not evident during each sampling period, but there appears to be a general trend in the distribution over the study period. This trend is evident in the apparent movement of the area of highest concentrations of dieldrin between sampling periods. Over the study period, this area appears to have moved northeast from Basin F, crossed "D" Street about halfway to the boundary, and then moved north reaching the North Boundary System just east of "D" Street. The highest concentration of dieldrin found on the Arsenal in the study area during each sampling period ranged from under 5 ppb to 50 ppb. Small concentrations of dieldrin were found in some of the wells north of the Arsenal during the first sampling period. Most of the concentrations had decreased to below the detectable limit by the end of the study period.

87. Endrin - The analytical data indicate a distribution of endrin extending from just northeast of Basin F to the North Boundary System (Plates IC-44 thru IC-47). The extent of the distribution varied somewhat between sampling periods. During the first, second, and fourth periods, the areas of high endrin concentrations stretched from Basin F northeast to across "D" Street and then north along the east side of "D" Street to the North Boundary System. During the third sampling period, however, the plume was located west of "D" Street. This may be a result of the particular wells which were sampled during each period. The highest concentrations of endrin found on the Arsenal in the study area during each sampling period ranged from under 5 ppb to 60 ppb. Concentrations of endrin were found in some of the wells north of the Arsenal during the first sampling period. The concentrations had decreased to below the detectable limit by the end of the study period.

Significance of Sand Zones in the Denver Formation

88. The detailed stratigraphy of the Denver Formation was not clearly understood at the time the North Boundary Pilot containment system was

constructed. The Denver Formation at that time was considered to be impermeable for the most part. Later studies revealed that the Denver Formation contained laterally extensive sand zones that transmit water. During the construction of the North Boundary expansion the presence of the Denver sand, was taken into consideration. If a Denver sand zone was encountered near the bottom of the slurry wall, the wall was extended down past the base of the sand. In areas where Denver sands were found at deeper depths dewatering wells were placed to monitor and potentially intercept any contaminated ground water that might migrate into the area below the slurry wall.

89. Cross section B-B' shows the position of the base of the barrier wall in relation to the top of the Denver Formation and to the sand zones within the Denver. In the area of the Pilot System (Borings 1017, 1018, and 1019) a zone of sand occurs near the bottom of the slurry wall. Under the right hydrologic conditions this sand could act as a conduit for ground water to move underneath the slurry wall.

90. The isoconcentration maps and to some degree the water table maps indicate that water is going under or through the barrier in this area. Figure 13 shows monitoring data indicating contaminants passing under the barrier. The water can be moving past the barrier in one of three ways. One possibility is that the pilot slurry wall has deteriorated because of contact with the various types of chemicals in the ground water. A second possibility is that the bottom of the barrier wall is in contact with a laterally extensive Denver sand zone. During periods when the discharge wells were not working, the head on the upgradient side of the barrier would be high enough to drive water through the Denver sand unit and under the barrier. A third possibility is that a Denver sand zone underneath, but not in direct contact with, the bottom of the barrier could be hydraulically connected to alluvial water. This connection could occur to the south of the barrier where a deeper bedrock channel cuts through Denver sand units (Figure 14). Again the increase in hydraulic head which occurred during times when the system was not operating could have driven water through the Denver sand zone and under the barrier. Denver sand zones are also in close proximity to the bottom of the slurry wall in the vicinity of Boring 1015. The water level maps and isoconcentration maps do not indicate that contaminants are penetrating the control system near Boring 1015. The orientation and hydraulic parameters of the Denver sands need to be clearly

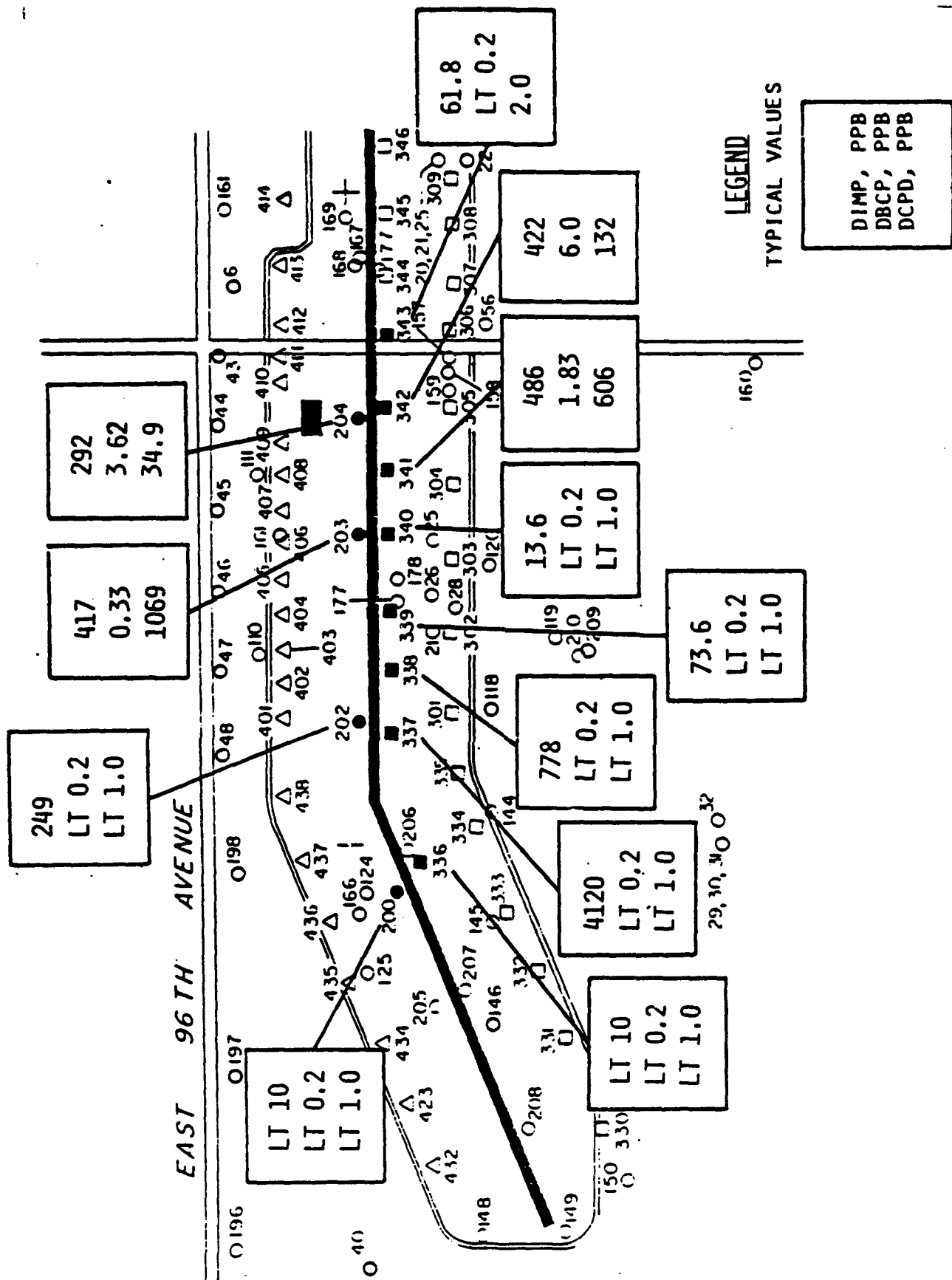


Figure 13. Concentrations of contaminants in ground-water samples collected from wells screened in Denver sand units.

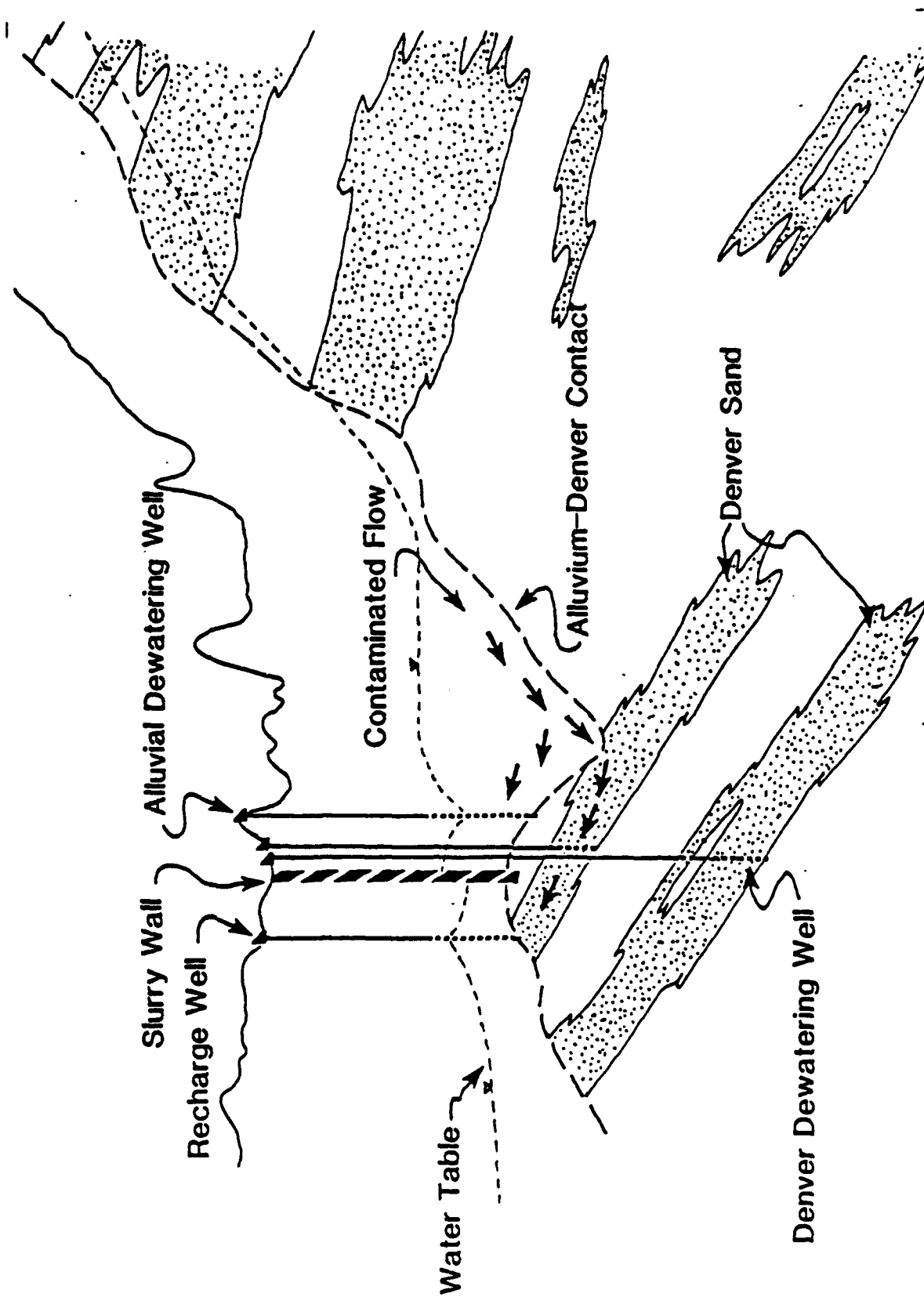


Figure 14. Idealized cross-section illustrating a potential pathway for contaminated ground-water flow under the slurry-wall barrier.

defined in order to assure containment of contaminated ground water. Assuming that the slurry wall itself is intact, the Denver sand zones and correct water table gradients become the key factors in containment at the north boundary.

91. Besides the potential for contaminants to move through the Denver sand lenses because of elevated upgradient water levels, contaminated water can also be transmitted because of poorly constructed wells. For example the conductor casing for well DW-42 was installed in such a way that it did not isolate upper aquifers and therefore more than one water bearing Denver interval is recharging the screened section. See Figure 15. Thus, the apparent deeper contamination may not be valid at well DW-42. Some of the Denver discharge wells were brought on line because of the contamination identified in the water. Pumping of the Denver wells may have caused contamination from the alluvium and upper Denver units to be pulled further down into the Denver. Contamination is showing up in Denver sand wells on both sides of the barrier system.

Contaminant Concentration Trend Analysis

On Post Monitoring Wells 23043, 23047 and 24006

92. Six monitoring wells have been selected based on their strategic location in the pathway of the highest concentrated DIMP plume both on and off post. The three on post wells 23043, 23047 and 24006 are located along the Rocky Mountain Arsenal property line approximately 200 feet north of the recharge well alignment. These three monitoring wells are screened in the alluvial aquifer and have a historical data base originating in 1978.

93. Well 23047 is 1000 feet west of D Street and is located in an area of low permeability. The recharge line in this same area exhibits low recharge of treated ground-water. For this reason well 23047 is a good indicator of system effectiveness. The trend plots for well 23047 DIMP concentrations vs time in years is shown at Figure 16. Although significant scatter is evident in the data, likely due to variations in sampling and analysis methods and system operations, the long term trend is downward, ranging from 3514 ppb in 1978 to 501 ppb in 1984. No analytical data was collected on the well between Jan 81 and Mar 83, as well as in Jul 84. Reductions in DIMP concentrations are evident from 1978 to 1979 from operation of the Pilot Containment/Treatment System.

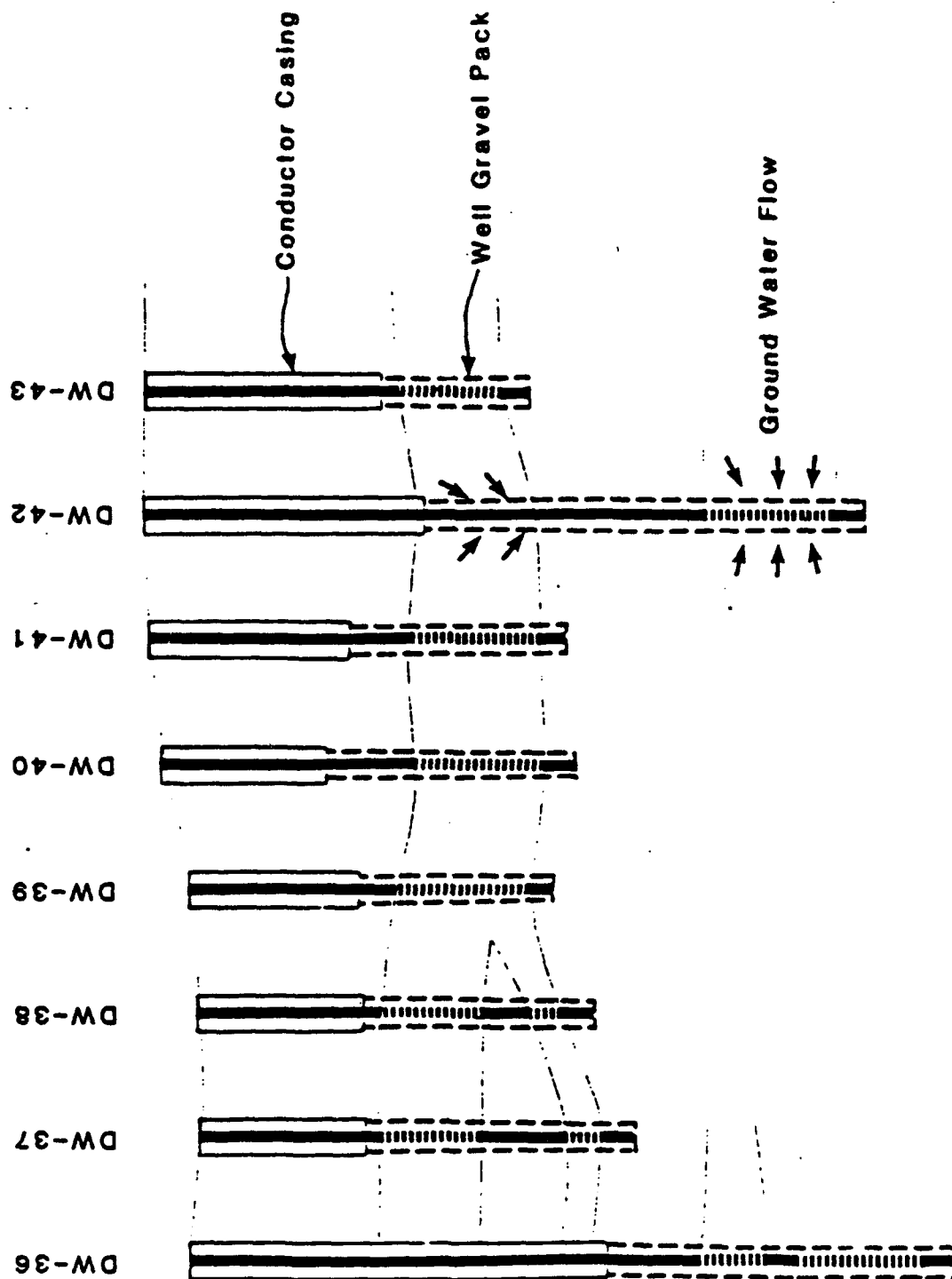
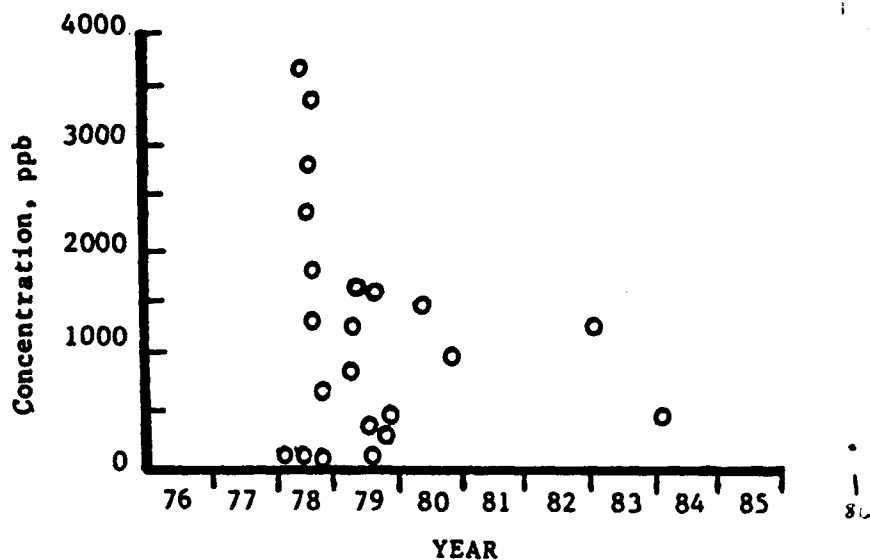


Figure 15. Cross-section of selected dewatering wells illustrating the potential for contaminated ground water movement into deeper water-bearing zones due to poorly constructed wells.



Sample Date		Concentration
	Mo/Yr	ppb
1.	Jun/78	47
2.	Jul/78	54
3.	Jul/78	3514
4.	Aug/78	3436
5.	Aug/78	2341
6.	Aug/78	2780
7.	Sep/78	1800
8.	Sep/78	1340
9.	Oct/78	19
10.	Nov/78	730
11.	Mar/79	876
12.	May/79	1303
13.	Jul/79	1588
14.	Jul/79	1526
15.	Aug/79	73
16.	Sep/79	348
17.	Nov/79	308
18.	Dec/79	537
19.	Jun/80	1460
20.	Jan/81	1020
21.	Mar/83	1250
22.	Apr/84	501

Figure 16. Concentration of DIMP versus Time in well 23047

94. Monitoring well 23043 is located on-post at the corner of D Street at 96th Ave. This well is screened in a more productive aquifer and therefore shows rapid changes in water quality based on flow through the system. The trend plots for well 23043 are shown at Figure 17. This well has cycled from highs to lows and currently shows lower concentrations as measured from 1984 monitoring data. No analytical data was collected on this well between Apr 82 and Apr 84.

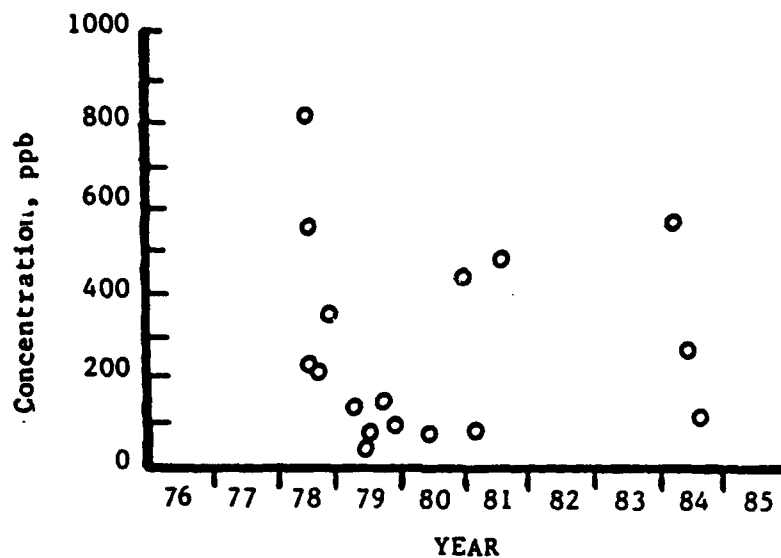
95. Monitoring well 24006 is 300 feet east of D Street, along the fence, and is also located in a more productive aquifer. The trend plots for well 24006 are shown at Figure 18. The DIMP concentrations for this well show significant reductions ranging from 1090 ppb in 1978 to 93 ppb in 1982. Since 1982, measurements show this well to be dry.

Off-Post Wells 37308, 37309 and 37313

96. Off-post monitoring well 37308 is located 700 feet north of RMA along Peoria Street and is viewed as a key indicator well in assessing the near term off-post effectiveness of the system operations. The trend plots for well 37308 are shown at Figure 19. Analysis of the DIMP concentrations shows a constant, continuing reduction from a high of 1190 ppb in 1978 to a low of 175 ppb in 1984.

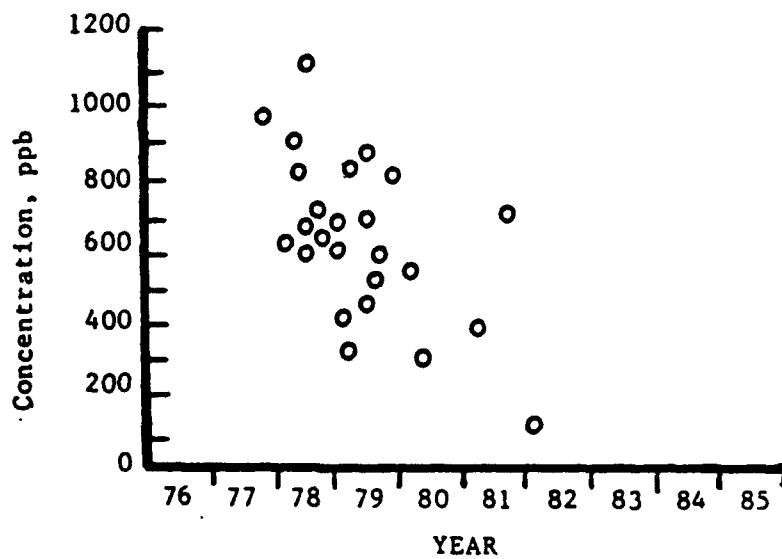
97. Off-post monitoring well 37309 is located 1600 feet north of RMA along Peoria Street. Well 37309 is an alluvial well which has shown a constant decline in DIMP concentrations which drop significantly from 1978 to 1981. The trend plots for well 37309 are shown at Figure 20. DIMP values range from a high of 3990 ppb in 1978 to a low of 796 ppb in 1984.

98. Off-post monitoring well 37313 is of recent interest in that it is located one-half mile northwest of the treatment system along Hwy 2. This well is located in the primary DIMP plume effecting off-post residents and was sampled in the 1985 off-post Risk Assessment Survey. Well 37313 is also an alluvial well and is thought to show variations in DIMP values caused by its location in the First Creek drainage system. The trend plots for well 37313 are shown at Figure 21. Analysis of the DIMP concentration data shows significant scatter but also indicates a trend downward in values from a high of 10,600 ppb in 1978 to a valve of 2170 ppb in 1984.



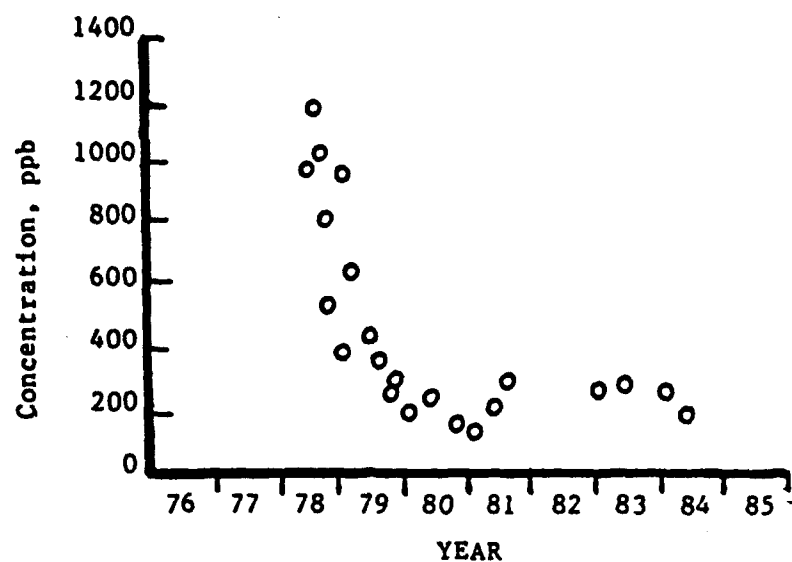
Sample Date		Concentration
Mo/Yr		ppb
1.	Jul/78	807
2.	Aug/78	565
3.	Aug/78	223
4.	Sep/78	223
5.	Dec/78	348
6.	May/79	128
7.	Jul/79	42
8.	Jul/79	65
9.	Sep/79	135
10.	Dec/79	68
11.	Jun/80	62
12.	Jan/81	429
13.	Apr/82	72
14.	Oct/81	478
15.	Apr/84	564
16.	Jul/84	240
17.	Oct/84	91

Figure 17. Concentration of DIMP versus Time in well 23043



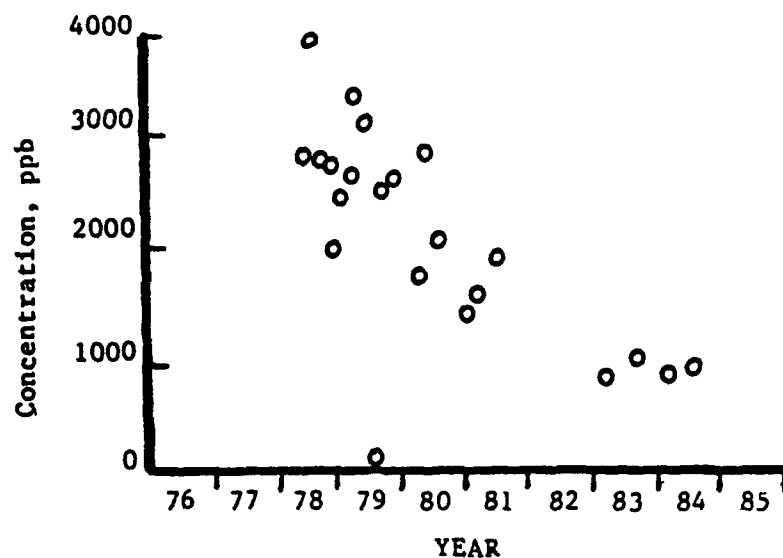
	Sample Date	Concentration
	Mo/Yr	ppb
1.	Jan/78	946
2.	Apr/78	611
3.	Jul/78	895
4.	Jul/78	800
5.	Aug/78	1090
6.	Sep/78	657
7.	Oct/78	700
8.	Oct/78	579
9.	Nov/78	620
10.	Jan/79	596
11.	Jan/79	639
12.	Mar/79	288
13.	Apr/79	390
14.	May/79	804
15.	Jul/79	842
16.	Aug/79	665
17.	Aug/79	457
18.	Oct/79	524
19.	Nov/79	555
20.	Jan/80	795
21.	Apr/80	513
22.	Jul/80	302
23.	Mar/81	379
24.	Oct/81	675
25.	Feb/82	93

Figure 18. Concentration of DIMP versus Time in well 24006



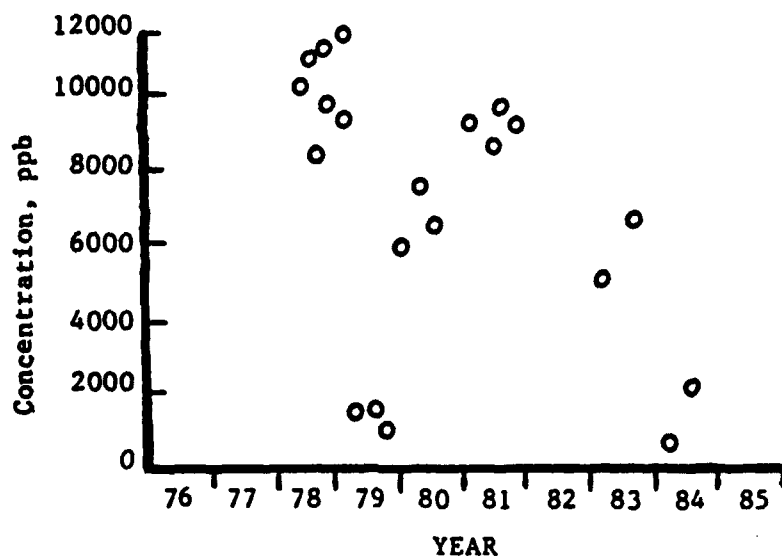
Sample Date		Concentration
	Mo/Yr	ppb
1.	Jul/78	996
2.	Aug/78	1190
3.	Sep/78	1057
4.	Nov/78	825
5.	Dec/78	519
6.	Jan/79	374
7.	Mar/79	971
8.	Apr/79	676
9.	Aug/79	427
10.	Sep/79	359
11.	Dec/79	258
12.	Jan/80	296
13.	Apr/80	201
14.	Jul/80	225
15.	Jan/81	139
16.	Apr/81	134
17.	Jul/81	205
18.	Oct/81	294
19.	Feb/83	243
20.	Jul/83	286
21.	Apr/84	265
22.	Jul/84	175

Figure 19. Concentrations of DIMP versus Time in well 37308



Sample Date		Concentration
Mo/Yr		ppb
1.	Jul/78	2858
2.	Aug/78	3990
3.	Sep/78	2870
4.	Nov/78	2794
5.	Dec/78	2020
6.	Jan/79	2540
7.	Mar/79	2650
8.	Apr/79	3355
9.	Jul/79	3209
10.	Aug/79	10
11.	Sep/79	2540
12.	Oct/79	2524
13.	Jan/80	2930
14.	Apr/80	1750
15.	Jul/80	2070
16.	Jan/81	1400
17.	Mar/81	1520
18.	Jul/81	1910
19.	Feb/83	766
20.	Jul/83	1110
21.	Apr/84	796
22.	Jul/84	902

Figure 20. Concentrations of DIMP versus Time in well 37309



Sample Date		Concentration
Mo/Yr		ppb
1.	Jul/78	10600
2.	Aug/78	8640
3.	Oct/78	11520
4.	Nov/78	9880
5.	Dec/78	11640
6.	Jan/79	11860
7.	Feb/79	9670
8.	Apr/79	1666
9.	Aug/79	1590
10.	Oct/79	990
11.	Jan/80	5970
12.	Apr/80	7920
13.	Jul/80	6640
14.	Jan/81	9560
15.	Apr/81	8550
16.	Jul/81	10100
17.	Oct/81	9330
18.	Feb/83	5120
19.	Jul/83	6590
20.	Apr/84	669
21.	Jul/84	2170

Figure 21. Concentrations of DIMP versus Time in well 37313

PART V: ASSESSMENT OF SYSTEM EFFECTIVENESS

99. The North Boundary System was constructed for the primary purpose of preventing the off-post migration of contaminated ground water. In order to evaluate the overall effectiveness of the operating system for achieving this purpose, the ability of the system to intercept and control contaminated ground-water flow and remove the contaminants from this flow must be assessed. The data available for making this assessment are those collected from the monitoring wells and the influent and effluent streams from the treatment plant. The availability of data for this study was in general sufficient for assessment with the exception of water level and analytical data for the ground water north of the Arsenal boundary. In addition to effectiveness, the reliability of the system must be evaluated because the effects of a failure may not be immediately evident.

100. The ground-water elevation maps indicate that the system has served as a barrier to the majority of alluvial flow along this area of the Arsenal boundary. The mechanical failure of some dewatering and recharge wells, coupled with the placement of some recharge wells in geologically unsuitable materials with respect to permeability, has resulted in the development of high water levels on the upgradient side of the barrier and low water levels on the downgradient side. This situation has been aggravated by periodic surface flooding. As a result, the bentonite barrier has tended to act as a "ground-water dam." Although ground-water flow is controlled under this scenario, the significant difference in hydraulic head across the barrier has a greater potential of resulting in a decrease in the effectiveness of the system. The large differential gradient tends to increase the flow of ground water and associated contaminants through or under the barrier. Of particular concern is the movement of contaminated ground water into and through the Denver sands. This quantity of water is estimated to be small in comparison to the total flow across the boundary and could be reduced substantially if the differential gradients could be eliminated.

101. The contaminant concentration maps indicate that the control system is intercepting and treating the majority of the contaminated alluvial ground water migrating toward the northern boundary of the Arsenal, however, the operational problems may be reducing the effectiveness of the system. Concentrations of major contaminants are still found north of the control system but

the exact source and distribution of the contaminants in this area could not be defined due to a lack of sufficient data. However, the available data from the few monitoring wells located immediately downgradient of the system generally indicate a downward trend in contaminant concentrations.

102. The data obtained from the analysis of influent and effluent samples from the treatment plant indicate that the plant is effectively removing organic contaminants. Inorganic contaminants such as chloride and fluoride are not being removed from the influent stream but are being redistributed downgradient of the barrier at an acceptable level due to the mixing and dilution that occurs in the treatment system. Operational problems do not appear to have impacted the ability of the treatment system to remove the contaminants. However, the failure of various system components has effected the treatment system. Flow surges resulting from starting up and stopping the system have resulted in additional loading of the filters with suspended solids and the flushing of carbon out of the adsorbers.

103. Thus, based on the available data, it appears that the North Boundary System is reducing the off-post migration of contaminated ground water. Some of the water level data tends to indicate that ground water is moving either through or under the barrier. Although the total amount of contaminants moving with this flow is unknown, it has been estimated at less than 4 gpm at the pilot system denver sand contact only. This situation may be resulting from or at least aggravated by the discontinuous nature of the system operation and by the inability to recharge sufficient water in the appropriate areas downgradient of the barrier. Once the operational problems are resolved and the system operates for a sufficient period of time so that water levels upgradient and downgradient can be balanced, ground-water flow through or under the barrier can be eliminated. System modifications can also be made that could significantly aid in controlling ground water bypassing the system.

PART VI: CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

104. Based on the evaluation of the data, the following conclusions have been drawn:

a. The expanded North Boundary Containment/Treatment System has been effective in reducing the off-post migration of contaminated ground water in the alluvial aquifer. Although downgradient monitoring wells continue to contain DIMP over current standards, key indicator wells immediately downgradient show major trend reductions in DIMP over the past seven years of monitoring.

b. Assessment of the changes in concentrations of chloride and fluoride from 1977 through October 1984, from analysis of the influent and effluent water quality indicate that these compounds are stabilizing or decreasing in concentration in the flow received by the Treatment System and that no immediate need exists for treatment equipment modifications to reduce their levels.

c. An area of possible flow (has been identified) between a Denver sand unit and the alluvial aquifer in the area of the pilot system barrier alignment. This flow has been estimated at less than 4 gpm. (The 4 gpm estimate is calculated for the Denver sand unit immediately beneath the pilot system only, using pre-construction gradients.)

d. The data obtained from the analysis of influent and effluent samples from the treatment plant indicate that the plant is effectively removing organic contaminants. Inorganic contaminants such as chloride and fluoride are not being removed from the influent stream but are being redistributed downgradient of the barrier due to the mixing and dilution that occurs in the treatment system.

e. During periods of operational difficulties, the bentonite barrier did serve as a ground-water dam. Although ground-water flow is controlled under this scenario, a significant difference in head across the barrier could result in a decrease in the effectiveness of the system. The resulting gradient would tend to increase the flow of ground water and associated contaminants through or under the barrier. If water levels upgradient and downgradient of

the system can be balanced, ground water flow through or under the barrier can be potentially eliminated.

Recommendations

105. As a result of the assessments made in previous chapters, the following recommendations have been developed and are being acted on.

a. A geotechnical study should be conducted along the alignment of the bentonite barrier to assess its physical condition to serve as a hydraulic barrier. Special emphasis should be placed in the area of the original pilot system barrier.

b. A ground water hydrologic study should be conducted in the area of the barrier to define the orientation and hydrologic conditions of the Denver sand units immediately adjacent to the barrier and to clarify the flow direction and fate of contaminants previously found in some of these units. In conjunction with this investigation, additional monitoring wells should be installed in these Denver sand units to increase the spatial distribution of monitoring points.

c. A study should be conducted to evaluate the current dewatering and recharge systems as to their adequacies and to develop and evaluate dewatering and recharge systems alternatives so as to optimize systems effectiveness.

d. The system monitoring program needs improvement. The frequency and density of the monitoring program should be increased and standardized. Additional off-post monitoring wells are needed. Certain key wells should be selected for more frequent monitoring than the quarterly system currently used. Consideration should be given to the use of continuous recorders on some of these key wells to support operational decisions. The chemical analysis conducted by the operations and monitoring teams should be standardized.

e. Additional post-treatment filters capable of removing carbon particles of less than 100 microns in size should be installed.

f. An additional effort should be made to remedy the problem of inadequate surface water drainage in the area of the barrier resulting from the undersized culverts located under 96th Avenue where First Creek exits RMA.

g. An evaluation of system reliability should be made with the goal of developing system modifications aimed at minimizing system down time. These modifications would include such things as standby equipment/systems an

alternate power supply, onsite spare parts inventories, on-call recharge and dewatering well cleaning capability, and on-call maintenance and repair capabilities.

h. An operational plan should be developed and implemented that would provide guidance on maximizing system effectiveness dependent on such factors as: equipment operating status, regional ground water levels, individual dewatering and recharge well ground water levels, dewatering capability, recharge capability, etc. All operations personnel should be trained in the use of this plan and in the relationships between operational procedures and system response. The operational plan should also include lists of periodic system inspections to be made by personnel and standardized formats for collecting and recording data.

APPENDIX A: SAMPLE COLLECTION PROTOCOL

RMA SAMPLING PROTOCOL

INTRODUCTION

This ground water sampling protocol for the Rocky Mountain Arsenal (RMA) is composed of five major sections. They are (1) well preparation, (2) sample collection preparation, (3) sample collection and preservation, (4) equipment cleanup, (5) sample submission to the laboratory and data management.

The protocol is based upon past sampling experience, small, informal field studies, knowledge of well construction and site hydrology, and some common sense.

I. Well Preparation.

A. Explanation of well types commonly found at RMA. (See figures 1-4).

1. Type I. The well is screened through the entire thickness of the aquifer and the water table coincides with the top of the screened interval (1 foot).
2. Type II. Same as Type I except that the water table is more than one foot below the top of the screened interval but above the bottom of the screen.
3. Type III. The well is screened through the coarse-grained water bearing strata thickness of the aquifer but the water table is much higher than the top of the screened interval.
4. Type IV. The well is screened through a small part of a thick aquifer and the water table is near the top of aquifer.

B. RMA well sampling methods in order of preference.

1. Pump equipped without a packer unit.
2. Pump without a packer unit.
3. Bailer.

C. Type I well samples.

1. Methods 1 and 2.
 - a. Lower the pump into the well so that its intake is at the middle of the screened interval.
 - b. If Method 1 is used, the packer need not be pressurized as representative water is in the screened interval.
 - c. Purge the well for three minutes before sampling. Pumping may be continued for up to 20 minutes to achieve stable water quality. Monitor pH, conductivity, and temperature while pumping.

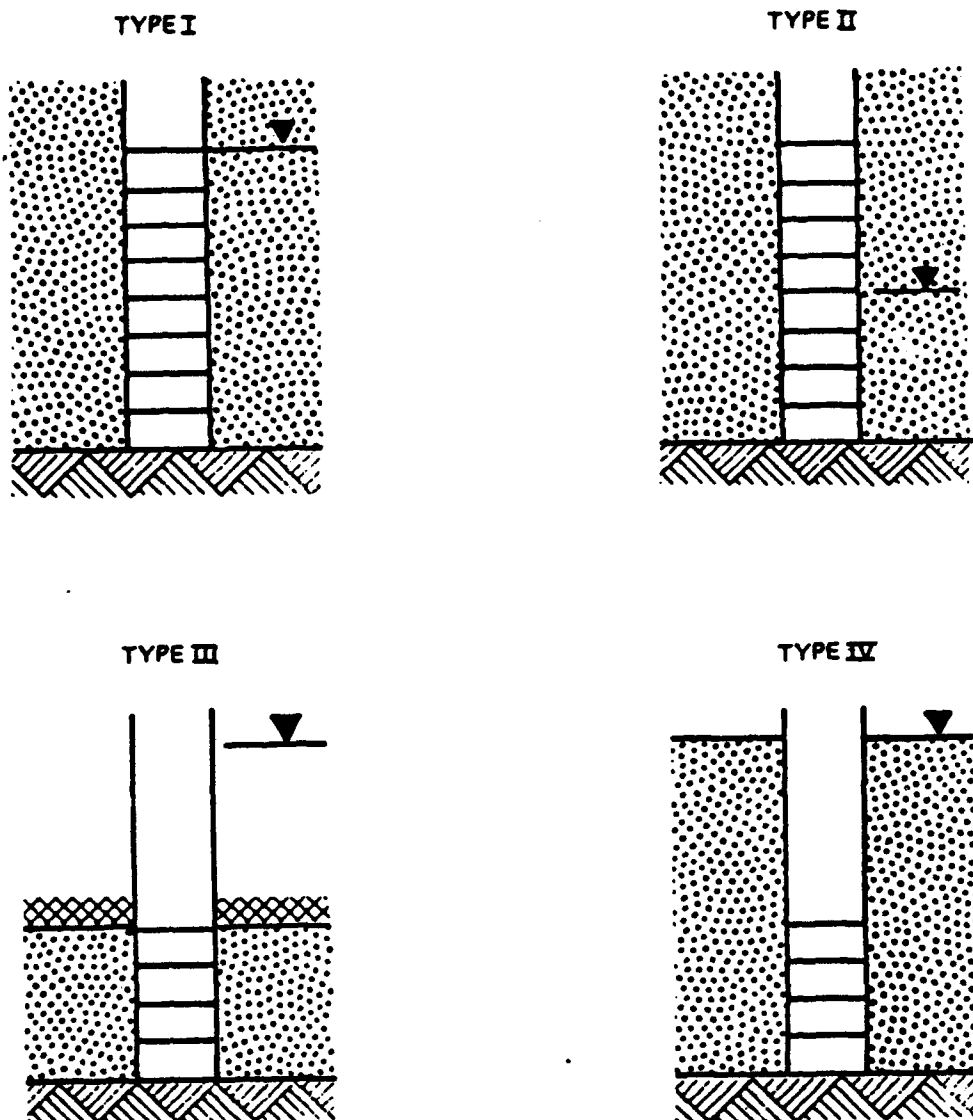


Figure 1. Rocky Mountain Arsenal well types.

d. If after 20 minutes, pH, conductivity, and temperature have not stabilized, collect a sample and note the conditions at the well.

(1) Do not pump more than 20 minutes.

(2) Return to the well at a later date to further develop the aquifer.

2. Method 3.

a. Remove 10 bailers of water before sampling

(1) 4' x 2' bailer for 2' diameter wells

(2) 2' x 3' bailer for 4' diameter wells

(3) A larger number of shorter bailers will need to be removed if a 4' x 2' bailer will not fit into the well due to an obstructed casings.

(4) Monitor pH, conductivity, and temperature after removing the first, fourth, seventh, and tenth bailers from the well.

b. Collect the sample if the water quality has stabilized.

(1) If water quality has not stabilized, remove an additional 5 bailers of water. Then check pH, conductivity and temperature.

(2) If water quality has stabilized, collect the sample.

c. If, after 20 bailers have been removed and water quality has not stabilized, collect a sample and note the conditions at the well.

(1) Do not remove more than 20 bailers.

(2) Return to the well at a later date to further develop the aquifer.

D. Type II well samples.

1. Follow sample collection procedures for Type I wells.

2. Placement of the pump intake will be between the top of the water table and the bottom of the screened interval.

E. Type III well samples.

1. Method 1.

a. Position the pump in the well so that the bottom of the packer is at the top of the screened interval.

b. Inflate the packer to isolate stagnant water.

(1) Use 40 psi for 2-inch wells.

(2) Use 60 psi for 4-inch wells.

c. Purge the well for 3 minutes before sampling. Pumping may be continued for up to 20 minutes to achieve stable water quality. Monitor pH, conductivity, and temperature while pumping to determine when representative water is being pumped.

d. If after 20 minutes, pH, conductivity, and temperature have not stabilized, collect a sample and note the conditions at the well.

2. Method 2.

a. Locate the pump intake at the middle of the screened interval.

b. Pump at a rate that minimizes aquifer stress.

(1) Monitor the water level during pumping to determine whether the aquifer has been stressed.

(2) Monitor pH, conductivity, and temperature during pumping to determine when representative water is being pumped.

c. Once representative water is being pumped, purge for an additional 3 minutes before sampling.

d. If water level drops more than three feet, allow the well to recharge to its initial water level before sampling.

3. Special cases - Methods 1 and 2.

a. In cases of low production wells, it may be advantageous to evacuate the entire well, then collect samples from the recharge water.

b. Repositioning of the pump is required as the water level drops in the well. After the well is evacuated, monitor the water level to determine the rate of recharge. If the well requires more than 30 minutes to recharge, move to another site. Return the following day to collect samples.

c. In cases where neither pump type can be positioned at the desired level, pumping can be done from any level to remove water. The volume to be removed is that quantity of water in the blank casing above the top of the screen. Do not include the length of the screen or any trap section below it when calculating the quantity of water to be removed. Monitor pH, conductivity, and temperature to determine when representative water is being removed. Once representative water is being removed, purge for an additional 3 minutes before sampling. If the required volume of water cannot be removed in a reasonable amount of time by pumping, use the bailer method (Method 3).

4. Special cases - Method 3.

a. Remove the stagnant water in the casing above the screen as for Methods 1 and 2.

b. Monitor pH, conductivity, and temperature to determine when representative water is being removed.

c. Remove an additional 10 bailers of water before collecting samples.

d. Use a 4' x 2' bailer for 2' wells and a 2' x 3' bailer for 4' wells. Ten bailer volumes of these sizes are approximately five gallons (20l.). Where a 4' x 2' bailer cannot be used, a greater number of shorter bailer volumes will need to be removed to approximate five gallons.

e. For a low production well, bail it dry. Then collect samples from the recharge water.

F. Type IV well samples.

1. Sampling methods for this type of well are the same as for Type III wells.

2. The Contamination Migration Branch discourages the use of this type of well for contaminant analysis because of the well construction.

3. If sampling and analysis is required from this type of well, it should be noted that water quality data will not be representative of the water in the entire aquifer.

G. Choosing the sampling method.

1. Use Methods 1 and 2, where practical, to minimize sample collection work.

2. Where grossly contaminated water is suspected, use Method 3, even though Methods 1 and 2 would work.

II. Sample Collection Preparation.

A. Identify program requirements for laboratory analysis.

B. Compare the program requirements with the laboratory's volume requirements and the Environmental Protection Agency and U.S. Geological Survey recommendations for collection, preservation, and storage of samples. This comparison will determine the number, size, and type of sample containers needed for each well and whether any samples need filtration or preservation.

C. Once the requirements are determined for bottles, filtration, and preservation of samples for a program, then sample collection equipment can be prepared for field use.

D. The minimum requirement for field monitoring of water quality is temperature, conductivity, and pH. Additional parameters may be monitored according to program needs.

III. Sample Collection/Preservation.

A. Preliminary steps.

1. Set out sample bottles.
2. Prepare bottle labels and attach them to bottles.
3. Set up filtration apparatus if required.
4. Select proper acid preservation ampules or reagent bottles.
5. Have analytical instruments calibrated for analyses that are required other than pH, conductivity and temperature. Frequency of calibration depends upon instruments and water quality. Generally, calibration can be done before sampling the first well and after sampling the last well.

B. Collection of water samples.

1. Draw a sample of water into a clean beaker or other container for additional analytical measurements if required.
2. Place the analytical probes into the container of water and allow a few minutes for stabilization.
3. During instrument stabilization time, begin filling the required sample containers with water.
4. Record the pH, conductivity, and temperature readings that were taken as part of the well preparation step in the field notebook. Also record the additional analytical measurements taken in the notebook.
5. Complete filling of sample bottles, taking care to avoid aeration of the water during the filling operation.
6. If required, filter and collect a water sample for metals. Collect 500-700 ml of water in a 1,000 ml beaker. Pump the water through the filter assembly with a peristaltic pump. Collect the filtrate in a suitable container and preserve with proper acid if required.
7. Preserve the samples according to the program requirements.
8. Store the samples in secure containers for transport to the laboratory.

IV. Equipment cleaning.

A. Keck pump.

1. Low level contamination or no contamination.
 - a. Deflate the packer if set.
 - b. Switch the pump to the reverse direction. Run it for 30-40 seconds to purge well water from the discharge hose. As soon as the ammeter reading on the pump battery pack drops, turn off the pump.
 - c. Start pulling the pump out of the well. As the hose is withdrawn from the well, rinse it with distilled water and wind it up on the reel. When winding up the hose, the power cable must be disconnected from the hose reel.
 - d. After the pump has been removed from the well, rinse it with distilled water immediately. Then submerge the pump in a container of distilled water.
 - e. Reconnect the power cable to the hose reel. Connect the pump discharge hose to a distilled water source.
 - f. Switch the pump to the reverse mode and let the pump run for 3-5 minutes.
 - g. Switch off the pump power. Take the pump out of the container of water. Switch the pump power to reverse mode for 30-40 seconds to purge the discharge line as in step 2. Disconnect the discharge line from the distilled water source.
 - h. Disconnect the discharge line from the pump and the power cable from the hose reel. Restore the pump, hose reel, and battery pack to their travel positions.
 - i. This cleanup procedure is mandatory regardless of water quality.
2. Gross contamination.
 - a. Perform the cleanup as described for low level contamination.
 - b. Following the initial cleanup, a detergent solution cleanup is required.
 - c. Detergent cleanup procedure.
 - (1) Prepare 3-5 gallons of detergent solution using hot water.
 - (2) Submerge the pump in the detergent solution and place the end of the discharge hose in the cleaning solution.

(3) Turn on the pump, either direction is suitable. Run it for 3-5 minutes to recirculate the cleaning solution through the pump and discharge hose.

(4) Turn off the pump. Thoroughly scrub the outside of the pump with a brush.

(5) Rinse off the detergent from the pump. Then place it in a 5 gallon container of water. Turn on the pump to the forward direction. Run it until the water is exhausted from the pump and discharge hose.

d. Restore the pump, hose reel, and battery pack to their travel positions after disconnecting the discharge line and power cable as in step h of the low level contamination pump cleanup.

B. Bailer cleaning.

1. Immediately upon removal from the well, the bailer should be thoroughly rinsed both inside and outside with distilled water. This step must be done regardless of the well water quality.

2. In case the bailer has been used in a grossly contaminated well, it must be thoroughly scrubbed with a detergent solution followed by a distilled water rinse.

3. Replace the bailer in its protective case.

C. Filter apparatus and analytical equipment.

1. Disassemble the filter apparatus and wash it with distilled water.

2. Rinse the analytical probes with distilled water and blot off the excess water.

3. Reassemble the filter apparatus with a new filter.

4. Restore filter apparatus and analytical equipment to their travel positions.

D. Special considerations.

1. The use of a pump in a grossly contaminated well is discouraged. Time saved in removing water from a well by pumping is lost in a longer cleanup time when compared to the use of a bailer.

2. Bailing is the preferred technique in removing water from a grossly contaminated well. Although bailing is generally slower than pumping, bailer cleanup is faster than pump cleanup. This results in a saving of time at a grossly contaminated well.

3. A decision will have to be made in the field as to whether gross contamination has been encountered. This decision should be based upon color and odor of well water, site location, hydrologic conditions and well construction. Whether gross contamination has been encountered at a well will affect the sampling technique and cleanup procedure used.

4. All cleanup procedures are to be done with distilled water. Wherever 'water' is referred to in the cleanup procedures, 'distilled water' is what is meant.

APPENDIX B: TREATMENT PLANT OPERATIONS SUMMARY LOG

NORTH BOUNDARY CONTAMINATION TREATMENT SYSTEM
PLANT HISTORY

10/6/83 The treatment plant operated satisfactorily.

10/13/83 The treatment plant operated satisfactorily.
The east recharge well breaker would trip and would not reset.
The east recharge well flows were then controlled manually by
partially closing the main inlet valves.

10/20/83 The treatment plant operated satisfactorily.

10/27/83 The treatment plant operated satisfactorily.
All the dewatering and recharge wells operated satisfactorily.

11/3/83 The treatment plant operated satisfactorily.
Recharge wells No. 17 and 23 were overflowing. This condition
was corrected by reducing the flow through the main inlet
valve.

11/10/83 The treatment plant was shut-down for two (2) days to remove
3378 lbs of spend carbon from "A" Adsorber. Only 1485 lbs or
regenerated carbon was added to 'A' Adsorber.

11/17/83 The treatment plant operated satisfactorily.

11/23/83 The treatment plant operated satisfactorily.
Since the west recharge wells have low flow rate, recharge
wells 32-38 and 1-9 were taken off-stream and the strainers
removed due to the extensive cold weather forecast.

12/1/83 The treatment plant operated satisfactorily. Recharge well 10
was taken off stream due to a broken water line.

12/8/83 The treatment plant operated satisfactorily.
The pressure gauges were removed for calibration checks and then the calibrated pressure gauges were reinstalled.

12/15/83 The treatment plant operated satisfactorily.

12/22/83 The treatment plant operated satisfactorily.
Recharge well 18 was overflowing. This condition was corrected by reducing the flow through the main inlet valve.
Recharge well 22 was taken off-stream due to a broken water line.

1/5/84 The treatment plant was shut-down to remove 2920 lbs of spent carbon from 'A' adsorber and 2920 lbs of spent carbon from 'B' adsorber. 2920 lbs of less contaminated carbon was transferred from 'C' adsorber to 'A' adsorber.
The auxiliary waste sump overflowed because the float switch did not function correctly. The waste sump was pumped down to correct the problems. The contacts in the switch were cleaned.
Dewatering wells 3 and 19 have broken check valves caused by water freezing in the line. The pumps were then turned-off.

1/12/84 The 'A' line was shut-down for one (1) day to permit plugging and drying of the dewatering well three (3) water lines. The 'C' line was shut-down for five (5) hours to permit plugging of dewatering well 19 water line.

1/19/84 The treatment plant operated satisfactorily. The auxiliary waste sump float control float was freed from the ice.

1/26/84 The plant was shut-down for two (2) days to allow for carbon transfer. Transferred 3017 lbs of spend carbon from 'A' adsorber to the spent carbon storage hopper. Then 3017 lbs of less contaminated carbon was transferred from 'C' adsorber to 'A' adsorber.

2/2/84 The treatment plant operated satisfactorily.

2/9/84 The treatment plant operated satisfactorily.
The broken line in recharge well 10 was repaired by
maintenance.

2/16/84 The treatment plant operated satisfactorily.

2/23/84 The treatment plant operated satisfactorily.

3/1/84 The treatment plant operated satisfactorily.

3/8/84 The treatment plant was found flooded in the morning of 3/7.
The auxiliary float switch was cleaned again. The 'C' adsorber
septa screen was backflushed to eliminate the blinding or
plugging condition. The lower sample port nipple f 'B'
adsorber broke while taking a water sample. The sampling valve
was then assembled directly to the nipple projecting from 'B'
adsorber.

3/15/84 The treatment plant was found in a non-operational mode in the
morning of 3/14. The auxiliary waste sump was so full that the
float switch had turned off the three (3) influent adsorber
pumps. When the plant was made operational, the 'C' adsorber
septa screen was backflushed to eliminated the blending
condition.

3/22/84 The treatment plant operated satisfactorily except the 'C'
adsorber septa screens were backflushed once this week.

3/29/84 The treatment plant operated satisfactorily except the 'C'
adsorber septa screens were backflushed once this week.

4/5/84

The treatment plant was shut down for (1.5) days to allow the sumps to fill with water and for the carbon transfers of fresh and spent carbon from and to the hopper truck to and from their respective storage tank. During the spent carbon transfer to the hopper truck, the 4" water line adapter flange broke; an expansion plug was inserted in the line to temporarily stop the water flow.

4/12/84

The treatment plant was shut-down for one (1) day to replace 5130 lbs of spent carbon with fresh carbon in 'A' adsorber. The malfunctioning auxiliary sump float switch was repaired by cleaning the contacts.

4/19/84

The treatment plant was shut-down for two (2) days to replace 5776 lbs of spent carbon with fresh carbon in 'B' adsorber. Then transferred 4455 lbs of fresh carbon to 'C' adsorber. An additional 2970 lbs of spent carbon from 'A' adsorber, 1485 lbs of spent carbon from each 'B' and 'C' adsorber were transferred to the spent carbon storage hopper. Fresh and spent carbon were transferred from and to the hopper truck to and from their respective storage tanks. The recharge well 9 inlet line temporary cap was resecured after blowing off.

4/26/84

The treatment plant was in a non-operational mode in the morning of 4/23 with the effluent and 'A' adsorber influent sumps overflowing. The thermal overload boxes and motor starter contacts were noted to be defective in P1 and P4 motor control panel. The failure was attributed to a lightning strike.

The treatment plant was shut-down to make electrical repairs to control panel and kept down at the request of the Sheriff due to the first creek overflowing on 4/25. The treatment plant was back on stream at 1630.

The treatment plant was shut-down for one (1) day to transfer 2153 lbs of fresh carbon to 'A' adsorber; 1485 lbs to 'B' adsorber and 2302 lbs to 'C' adsorber.

The P1 ('A' adsorber) and P4 (recharge line) sump pump motors were removed for repair. The 'C' adsorber pump was routed to supply contaminated water to 'A' and 'C' adsorber.

5/3/84

The treatment plant operated satisfactorily except for the shut-down of one (1) day to perform an electrical inspection of the MCC panel and a contamination inspection of the dielectric fluid in the outside transformer.

The 'B' adsorber was turned-off overnight to allow the PVC cement to set-up in the repaired 2" waterline from the auxiliary water pump to the 4" treated water downcomer.

The 2" waterline to the fresh carbon storage hopper eductor has a broken flange north of the shut-off valve that will have to be repaired.

Dewatering wells 11, 17, 18, 19 and 20 have electrical shorts that will require a crane to pull the submersible water pumps. Dewatering well 12 will also have to be pulled because of excess vibration and possible impeller damage.

Due to broken line, valve or missing parts the following recharge wells were replumbed: 2,3,8,9,20,22,32,37.

Normally closed solenoid valves replaced normally open solenoid valves in recharge well 3, 32 and 37.

Recharge wells 24, 25 and 28 have a short in the power supply cable which will require a backhoe to achieve access to the power supply cable.

Recharge wells 1,2,10,14,19,24,32,35-37 require circuitry checks because there is no indication of electrical supply.

Recharge wells 1,8,14,20 and 36 2343 overflowing. The water flow was reduced by partially closing the inlet main valve.

Fire hoses were installed in recharge wells 18 - 20 and routed to the bog to increase the water capacity through the treatment plant.

North Boundary Operating History Draft

MAY 1984

5/10/84

A, B and C adsorber septa screens had to be backflushed twice to eliminate a blinding condition. C adsorber was shut down for (1) night to allow the cement to set-up in the replaced dewatering well 19 check valve.

The repaired P1 (A adsorber) and P4 (recharge line) sump pumps were put back in service along with the new overload blocks and motor starter in the MCC panel.

Dewatering well 11, 17-20 pumps were pulled and all these pumps exhibited an electrical shorting condition. Dewatering well 12 pump exhibited excessive vibration and was pulled. Dewatering well 12, 18 and 20 pumps were repaired and installed.

5/17/84

The A, B and C adsorber septor screens required backflushing twice to eliminate a a blinding condition.

B adsorber influent water was routed to A and C adsorbers to supplement the restricted flows in A and C lines to permit repairs to dewatering wells that have broken plumbing.

Dewatering well 3 was isolated from A line to allow repairs to be made to the check and gate valves but could not be completed this week; dewatering wells 20 and 21 check valves were repaired and the wells were put back on stream. At this time dewatering well 20 acted as if it was plugged as indicated by the amperage reading; a check of the C line manifold revealed that the line was shut off at dewatering well 22. When the valve was opened at dewatering well 22, dewatering well 20 was flowing satisfactory.

The broken by-pass line in dewatering well 10 was repaired and the well was put in service.

The undersized thermal overload block was replaced with a larger capacity unit in dewatering well 8.

The malfunctioning flowmeter rotors were repaired in dewatering wells 10, 21 & 27.

The broken line in dewatering well 21 was repaired and the well was back in service.

A fire hose was routed from recharge well 421 to the bog to increase the treatment plant water flow capacity.

The malfunctioning solenoid valves were replaced with new units in recharge wells 2, 4, 12, 14 and 17.

Recharge wells 9 and 32 Dole valves were removed to eliminate a restricted flow condition.

Recharge wells 5, 6, 30 and 35 were cleaned of foreign matter to free the water lines.

5/24/84

To increase the flow of contaminated water through the treatment plan, the influent sump pump manifold valves were revised to supply to flow to each adsorber, as follows:

Adsorber	Through put from Flow (GPM)	Sump
A	200	B
B	100/50	A/B
C	<u>200</u>	C
Total	550	

With the increase in water flow though the adsorbers, daily back flushing of the septa screens was incorporated to control the blinding condition caused by carbon fines.

The adsorber influent sump water level probes were revised, as follows: The dewatering wells were made to operate independently of the sump pump controls; the (2) lower probes were set-up to control the sump pump the upper is ON and the lower is OFF; whereas, the (2) upper probes will control the dewatering well pumps (the upper is OFF and the lower is ON). This mode of operation will afford a near continuous sump pump operation.

The broken gate and check valves in dewatering well 3 were replaced with new parts and the well was returned to service. Dewatering well 6 had a defective motor thermal overload block replaced with a new part and the well was returned to service.

Recharge well 6 defective solenoid valve was replaced with a new part and the well was returned to service.

Recharge wells 12, 13 and 14 had leaking solenoid valves. The valves were cleaned and the wells returned to service.

The pressure regulators in recharge wells 11 and 12 were cleaned to allow the treated water to flow through.

The flowmeter rotors were plugged with foreign matter and the units were cleaned in recharge 5, 7, 10 and 11.

5/31/84

The treatment plant operated satisfactorily.

The hopper truck 4" water supply line outside West wall with the broken adapter flange was repaired and a 4" shut-off valve was installed in the line inside the building.

The broken 2" water supply line adapter flange at the fresh carbon storage bin educator was repaired.

Dewatering well 2 and 32 defective flowmeter rotors were repaired.

Recharge well 34 water line were cleaned to clear the blockage.

Recharge well 37 broken line was repaired.

The defective flowmeter rotor in recharge well 7 was repaired.

6/7/84

The waterflow through the adsorbers was reduced as follows:

Adsorber	Through Put Flow	From Sump	
		Former/	New
A	200/150	B	B
B	150/ 75	50B/100A	A Only
C	200/150	C	C
TOTAL	500/375		

Water flow from B sump to B adsorber was discontinued when C sump was emptied of contaminated water, C adsorber was taken off line to allow maintenance to repair a water leak in the C sump to the building supply line.

Dewatering well 5 electrical relay was replaced in the relay cabinet in the building.

The water level probes in dewatering well 31 were repositioned to correct an inverted position.

Recharge well 16 pressure regulator was cleaned to eliminate a blockage condition.

Recharge well 17 had a normally open solenoid valve replaced with a normally closed solenoid valve.

6/14/84

The treatment plant was shut down for (4) hours to repair a broken main valve in recharge well 8. One morning the PI and P3 sump pump switches were found in the OFF mode and then turned to automatic mode.

Recharge well 3 broken valve was replaced and the normally closed solenoid valve replaced the normally open solenoid valve. Also, debris from the broken valve was trapped under the solenoid plunger preventing the valve from closing. The debris was removed and the unit operates satisfactorily.

Recharge wells 12 and 13 were overflowing. Recharge well 12 flow was reduced by partially closing the main valve. Since recharge well 13 water flow could not be controlled, the well was shut down.

Recharge wells 22 and 24 burned-out coils were placed with new parts.

Since there was no electrical power east of recharge well 25, #4 cables was strung above ground between recharge wells 25-29.

Recharge well 30, water lines were cleaned to remove the blockage.

Recharge well 38 normally open solenoid valve was replaced by a normally closed solenoid valve and the main 1½ dia valve was replaced because the water line to valve cement did not hold. Recharge well 8 was completely replumbed including new valves and solenoid shut-off valve.

The turbine in the flowmeter sensor of recharge well 26 was repaired.

6/21/84

The treatment plant operated satisfactorily.

The adsorber flows were revised to the following new schedule:

Adsorber	Through Put Flow (GPM)	From Sump
A	150	B
B	210	110/A ; 100/B
C	150	C
TOTAL	510	

Dewatering well 49 starter relay was replaced so that the pump motor would be able to start.

The main breaker kept tripping in dewatering well 6. The pump was pulled and the red wire was found to be connected improperly. After the connection was secure the pump was put back in service, but still did not function properly.

Foreign matter was found in recharge wells 2, 12, 13, 21, 22 and 25 solenoid valves.

When the debris was removed, the units operated satisfactorily.

Recharge wells 2, 12, 26 had the water lines, flowmeter turbines cleaned of debris that was plugging the lines.

Recharge well 29 had the pressure regulator Dole valve and normally open solenoid valve removed and the water lines cleaned of foreign matter. A normally closed solenoid valve was installed and the water lines replumbed. The water flow was controlled by the by-pass valve until the normally closed contacts become available.

The flowmeter analyzer in recharge well 26 had to be reprogrammed because of faulty readings.

6/28/84

The treatment plant operated satisfactorily.

Two days were spent training personnel to transfer spent, fresh and top-off carbon in the adsorbers. 2970 lbs of fresh replaced an equal amount of spent carbon in B adsorber. A and C adsorbers were topped-off with 566 lbs and 936 lbs of fresh carbon, respectively.

The water flows in the adsorbers were revised to reflect that A sump supplied A adsorber, B sump to B adsorber, and C sump to C adsorber. This will be followed until the training session is completed to avoid the current confusion among the continual changing of personnel.

The new regimen will be as follows:

Adsorber	Through Put Flow (GPM)	From Sump
A	100	A
B	150	B
C	150	C
TOTAL	400	

Dewatering well 6 starting capacitor board was replaced with a new unit and the well is now functioning properly.

The broken water line in dewatering well 47 and the broken valve in dewatering well 36 were replaced with new parts.

The flowmeter rotors of dewatering wells 36, 42 and 52 showed no output through the analyzer. The rotors were cleaned and now function correctly.

Dewatering well 43 motor contactor does not energize in the 'auto' mode and the black motor lead showed an open condition. The pump was pulled for repair.

Dewatering well 11 short cycles. The relay contacts were cleaned and the problem was eliminated.

Recharge wells 13 and 21 were overflowing because the solenoid valve remains partially open. The solenoid valves were cleaned of foreign matter and now function correctly.

New normally closed contactors were installed for the normally closed solenoid valve in recharge well 29.

Recharge wells 23 flowmeter rotor was not signalling to analyzer. The rotor was cleaned and now functions.

7/5/84

The treatment plant operated satisfactorily.

One day was spent training personnel to transfer spent and fresh carbon from and to A adsorber. One blowcase load of 1485 lbs of fresh carbon replaced an equal amount of spent carbon.

To increase the flow of water through the adsorbers, necessitated another switch of adsorber to sump loading, as follows:

Adsorber	Through Put Flow (GPM)	From Sump
A	150	B
B	100	A
C	150	C
TOTAL	400	

The broken 4" water line to the fresh carbon storage hopper was replumbed. Bechtel construction started preparation to clean-out the recharge wells.

Recharge well 10 would not operate through its present configuration, but would operate through the by-pass valve.

The lines were found to be plugged. The water lines, flowmeter turbine and solenoid valve were cleaned of foreign matter and now operates satisfactorily.

Recharge wells 30 and 31 pressure regulators were replaced with straight water lines to avoid future stoppage of water flow.

7/12/84

The B adsorber was out of service for (3) days to drain the adsorber of resident water, inspect, remove and inspect the influent screens. Stones that varied in size to 0.25" dia were jammed in the 0.040" wide slots of the screen. Paper and unidentifiable matted material were, also, found. The carbon above the (2) west screens was packed so tight that the carbon bed effectively acted as a plug. After the packed carbon bed was broken loose and the screens were cleared of debris, the plumbing was reassembled using rubber gaskets in place of the original Teflon gaskets.

All (3) adsorbers were then set to operate at 150 gpm water flow from their own respective sumps.

Recharge well 29 normally closed solenoid valve electrical leads were connected and the well is now functioning.

Recharge wells 26, 27 and 28 had the pressure regulator removed and replumbed to eliminate another blockage source.

Recharge wells 27, 28, 30 and 31 normally open solenoid valves were replaced with no normally closed solenoid valves.

Recharge well 27 solenoid valve kept cycling on and off continuously. The water level probes were repositioned to eliminate the problem.

7/19/84

The laboratory results of the contaminated samples from the adsorber lower sample ports indicated that the adsorbers A and B had to be pulsed.

2970 lbs of spend carbon were replaced with fresh carbon in each A and B adsorbers (total 5940 lbs of carbon).

The leaking flowmeter turbine body was replaced with new unit in dewatering well 25 with the removal of the pressure regulators and replumbing of the water lines in recharge wells 23, 24 and 25, another line blockage source was relieved.

7/26/84

The treatment plant operated satisfactorily except one day was devoted to transferring 1485 lbs of fresh carbon to A adsorber. Flows through the adsorbers were revised, as follows:

Adsorber	Through Put Flow (GPM)	From Sump
A	130	A
B	200	B
C	180	C

The two broken lines in the 2" slurry line- one at the A adsorber and one at the carbon transfer blowcase - were replumbed.

Dewatering wells 39, 44 and 45 flowmeter turbine rotors were cleaned and put back in service.

The flow of treated water to the bog was temporarily terminated to reserve water supply to aid the recharge well clean-out by the contractor.

The main valve in recharge well 20 slipped-off the inlet feed line necessitating a plant shut-down for (6) hours to make the repair.

Recharge well 33 had the solenoid valve cleared, flowmeter rotor repaired and the Dole valve removed.

Recharge well 23 had the pressure regulator cleaned removed and the solenoid valve cleaned.

Recharge wells 35 and 37 had the pressure regulator and Dole valve removed, the solenoid valve cleaned, the flowmeter rotor repaired and the water lines repiped.

8/2/84

The treatment plant operated satisfactorily, except for three hours downtime to repair the main shut-off valve in recharge well 19. The main valve had slipped-off the feed line and had to be re-cemented.

8/9/84

The treatment plant operated satisfactorily.

Dewatering well 21 had the leaking flowmeter turbine body replaced with a new unit.

The yellow wire to the pump of dewatering well 9 was open. The pump was pulled, the wiring problem was corrected, the pump was reinstalled and put back in service.

Recharge well 12 had the pressure regulator removed and the water lines replumbed to relieve a plugging condition.

The solenoid valves and flowmeter turbines were purged of foreign matter in recharge wells 22 and 23.

8/16/84

The water treatment plant operated satisfactorily.

The spare communication cables (purple and green lines) replaced the original defective cables from dewatering well 9 to the main panel in B808.

Dewatering wells 7-22 were inspected for terminal connection security.

Recharge well 26 had the normally open solenoid valve with their electrical contacts replaced with a normally closed solenoid valve with their matching electrical contacts.

In recharge well 35, the defective flowmeter rotor was replaced with a new unit; the flowmeter analyzer was programmed for the new unit. Also, the solenoid valve was cleaned of foreign matter.

The 1st creek overflow on 8/9-10/84 was instrumental in lowering the treated water flow. Feeding the bog with treated water from recharge wells 18-21 was discontinued to help lower the water level in the bog.

Refill rates of A, B and C sumps were made to assist in setting the adsorber flow rates which were determined to be 94 GPM, 154GPM and 217GPM for A, B and C adsorbers, respectively.

A special study to determine the cause for the lack of flow from dewatering wells 7-11 was made. In each case, the water level in the well was noted to be between the high and low water level probe.

8/23/84

The water treatment plant operated satisfactorily except when the plant was shut-down one day to fill the influent sumps with water for the unloading of the fresh carbon from the hopper truck. After the hopper truck was unloaded and the spent carbon was transferred into the hopper truck, the plant was put back on stream.

The recharge well clean-out contract was completed.

Recharge well 27 solenoid valve was cleaned to relieve the continuous open condition.

The defective main valves in recharge wells 1 and 34 were replaced with new units.

Since the water level in the bog was still too high, the recharge wells 18-21 that feed treated water to the bog remained shut-off.

8/30/84

The water treatment plant was shut-down for one day to replace 2844 lbs of spent carbon with fresh carbon in A adsorber.

C adsorber flow meter was removed for cleaning of foreign matter to correct an erratic action during normal operation.

The broken east post filter drain line at the camlock fitting was repaired by maintenance.

The spent carbon blowcase became plugged with stones in the bottom at the line to the spent carbon storage hopper during the transfer of contaminated carbon from the auxiliary wastes sump. The debris was removed and the lines cleared for future operations.

An inspection of electrical connections was performed on all dewatering wells (1-54) to ensure that all connections were secure.

Recharge well 5 water lines were cleared of debris to relieve a partial plugging condition.

The overflowing condition in recharge well 26 was cleared when the foreign matter in the solenoid valve was removed.

9/6/84

B and C adsorber were topped of with fresh carbon totaling 424 and 1124 lbs, respectively; otherwise the treatment plant operated satisfactorily.

The water flows were increased through A an C adsorber; the revised water flow rates are as follows:

Adsorber	Through Put Flow (GPM)	From Sump
A	120	A
B	150	B
C	150	C

Dewatering wells 7, 9, 10 and 15 were shut-down to evaluate the water level of each of these wells.

9/13/84

The C adsorber sump pump was removed from service to correct the water leakage around the pump drive shaft and bushing bearing.

The flow rate through A adsorber was reduced to 110GPM after an A sump refill check averaged 86GPM. The reduction of only 10GPM lowered the down time of the sump pump and increased the over all average to 100GPM.

The water level checks that were made in dewatering wells 7, 9, and 10 revealed the alluvial water level was too low to reach the upper water level probe to operate the water pump. The water level in dewatering well 7 was located at the lower probe and dewatering well 9 and 10 water level was located midway between the upper and lower level probe. Dewatering well 15 could not be evaluated since the well cap could not be loosened enough to move the water level probes. The bolts and nuts in the cap were too corroded to loosen without possibly destroying the attaching parts.

9/20/84

The C adsorber sum pump motor was removed to install new seals on the pump shaft and in the pump shaft bushing bearing.

A broken water line was found in the Denver sands area as evidenced by the water seepage on the surface between dewatering well 50 and 51. To allow the area to dry enough for a back hoe operation, the Denver sands dewatering wells 47-54 were and the C line alluvial dewatering wells 25 through 29 were taken off stream. The balance of C line alluvial dewatering wells 19-24 were rerouted to enter the B line sump water supply. When the water seepage continued the complete C line was taken off stream. At this time, it was noted that Denver sands dewatering well 49 could not be controlled by the ON - OFF switch in the building's control panel. All the C line Denver sands were then controlled directly at the wells as a precautionary measure.

During the C line to B temporary alignment, the water supply to B sump was directed to B and C adsorber.

When the broken line between dewatering well 50 and 51 was repaired, the Denver sand wells that feed the C line remained off stream. To compensate for the C line down time, the adsorber flows were readjusted, as follows:

Adsorber	Through Put Flow (GPM)	From Sump
A	100	A
B	150	B
C	175	C

9/27/84

The laboratory results of the contaminated samples from A and B adsorber lower sample ports indicated that A and B adsorber had to be pulsed. 2970 lbs of spent carbon was replaced with fresh carbon in B adsorber.

The excessive vibration noted in C sump pump was corrected by realigning the pump drive shaft and retorquing the motor base attachment.

During the C pump repair operation the C line water supply dewatering wells 19-24 (25, 29, 47-54 off stream) was diverted to the B line water supply and the B sump pump was directed to supply both B and C adsorbers.

Upon completion of the repairs, the treatment plant was returned to normal operation.

A preliminary sump refill evaluation was performed with the following results:

A sump- 81.6 GPM

B sump- 189.1 GPM

C sump- 147.3 GPM

The adsorber flows were set, as follows:

Adsorber	Through Put Flow (GPM)	From Sump
A	100	A
B	150	B
C	150	C

10/1/84

Carbon transferring was completed by replacing 4078 lbs of spent carbon with fresh carbon in A adsorber and topping off C adsorber with 377 lbs of fresh carbon.

APPENDIX C: TREATMENT PLANT FLOW

NORTH BOUNDARY CONTAINMENT SYSTEM
TREATED WATER FLOW

	DATE	ADSORBER						TOTAL	
		A		B		C			
		GAL (00)	GPM	GAL (00)	GPM	GAL (00)	GPM	GAL (00)	GPM
1	10/6/83	2594	36	3419	47.5	5055	70.2	11068	153.7
2	10/13/83	4899	49.3	5091	51.3	7889	79.4	17879	180
3	10/20/83	5619	54.7	4990	48.6	7682	74.9	18291	178.2
4	10/27/83	5138	51.9	4415	44.7	6871	69.5	16424	166.1
5	11/03/83	5277	52.1	5566	54.9	7801	77	18644	184
6	11/10/83	4670	46.1	5148	50.8	6496	64.2	16314	161.1
7	11/17/83	5836	57.2	5111	50.1	6902	67.7	17849	175
8	11/23/83	4041	47.2	3342	39	5574	65	12957	151.2
9	12/01/83	5413	47.4	4893	42.8	7672	67.1	17978	157.3
10	12/08/83	4573	45.3	4116	40.7	6475	64.1	15164	150.1
11	12/15/83	4633	46	4032	40.1	6317	62.8	14982	148.9
12	12/22/83	4367	43.2	4140	40.9	6378	63	14885	147.1
13	12/28/83	3637	42.1	3513	40.7	5350	61.9	12500	144.7
14	01/05/84	5135	44.6	4767	41.1	6101	52.9	16003	138.9
15	01/12/84	3492	35.2	2666	26.9	6736	68	12894	130.1
16	01/19/84	4531	46.2	2234	22.7	5902	60.1	12667	129
17	01/26/84	2798	26.7	2418	23.1	5713	54.4	10929	104.2
18	02/02/84	3654	37.7	3080	31.8	6449	66.6	13183	136.1
19	02/09/84	3941	39	3408	33.8	7307	72.4	14656	145.2
20	02/16/84	3891	38.5	3427	33.9	7086	70.1	14404	142.5
21	02/23/84	3970	38.4	3351	32.4	7636	73.8	14957	144.6
22	03/01/84	3729	37.6	3203	32.3	7217	72.7	14149	142.6
23	03/08/84	3798	37.2	3649	35.7	7882	77.2	15329	150.1
24	03/15/84	3966	39.9	3433	34.5	2921	29.4	10320	103.8
25	03/22/84	4139	40.8	3722	36.6	5485	54	13346	131.4
26	03/29/84	3954	40.1	3713	37.7	5088	51.6	12755	129.4

NORTH BOUNDARY CONTAINMENT SYSTEM
TREATED WATER FLOW

		ADSORBER						TOTAL	
		A		B		C			
		DATE	GAL (00)	GPM	GAL (00)	GPM	GAL (00)	GPM	GAL (00)	GPM
27	04/05/84	4831	47.9	3433	34.1	1274	12.6	9538	94.6
28	04/12/84	836	8.1	1215	11.7	566	5.5	2617	25.3
29	04/19/84	5080	51.2	3235	32.6	4794	48.3	13109	132.1
30	04/26/84	1099	10.9	2307	22.9	3758	37.3	7164	71.1
31	05/03/84	1763	17.5	1935	19.2	5679	56.3	9377	93
32	05/10/84	7049	69.9	8729	86.6	9080	90.1	24858	246.6
33	05/17/84	8074	80.1	8729	86.6	11834	117.4	28637	284.1
34	05/24/84	11274	111.8	8113	80.5	10667	105.8	30054	298.1
35	05/31/84	12310	122.1	9842	97.6	11923	118.3	34075	338
36	06/07/84	14101	139.9	10018	99.4	8506	84.4	32625	323.7
37	06/14/84	13573	134.6	6713	66.6	8073	80.1	28359	281.3
38	06/21/84	13786	136.8	8649	85.8	9103	90.3	31538	312.9
39	06/28/84	13058	129.5	10674	105.9	9770	96.9	33502	332.3
40	07/05/84	11821	117.3	10283	102	11340	112.5	33444	331.8
41	07/12/84	16096	159.7	6641	65.9	11252	111.6	33989	337.2
42	07/19/84	11772	116.8	14629	145.1	11492	114.0	37893	375.9
43	07/26/84	8427	83.6	13055	129.5	11523	114.3	33005	327.4
44	08/02/84	9804	97.2	17530	173.9	13131	130.3	40465	401.4
45	08/09/84	7363	73	15988	158.6	12193	121	35544	352.6
46	08/16/84	6627	65.7	13306	132	6775	67.2	26708	264.9
47	08/23/84	5466	54.2	10989	109	8717	86.5	25172	249.7
48	08/30/84	6101	60.6	10985	109	9128	90.5	26219	260.1
49	09/06/84	8020	79.6	12732	126.3	12754	126.5	33506	332.4
50	09/13/84	8686	86.2	12345	122.5	13025	129.2	34056	337.9
51	09/20/84	8383	83.1	10368	102.9	4828	47.9	23579	233.9
52	09/27/84	8100	80.4	12351	122.5	14054	139.4	34505	342.3
53	10/01/84	4756	47.2	6913	68.6	7576	75.1	19245	190.9

NORTH BOUNDARY CONTAINMENT SYSTEM
TREATED WATER FLOW

DATE	ADSORBER						TOTAL	
	A		B		C			
	GAL (00)	GPM	GAL (00)	GPM	GAL (00)	GPM	GAL (00)	GPM
10/01/83- 01-03-84	64412	47.6	1st QUARTER 61310 45.3		91740	67.8	217462	160.7
01/03/84- 04/02/84	50414	38.9	2nd QUARTER 41928 32.4		77424	59.7	169766	131.0
04/02/84- 07/01/84	108456	83.7	3rd QUARTER 86251 66.5		98641	76.1	293348	226.3
07/01/84- 10/01/84	116493	87.9	4th QUARTER 162681 122.8		142682	107.7	421856	318.4
10/01/83- 10/01/84	339956	64.5	ANNUAL 352554 66.9		410800	77.9	1103310	209.3

APPENDIX D: TREATMENT PLANT INFLUENT AND EFFLUENT QUALITY

***** ANALYTE CONCENTRATION IN NORTH BOUNDARY TREATMENT PLANT INFLUENT AND EFFLUENT *****

USER SAMPLE DATE
NUMBER I.D. SAMPLE
NUMBER COLLECTED

ABSORBER A	DIMP	DCPD	DBCP	CPMS	CPMSO	CPMSO2	DITH	OXAT	CL	F	TOC	pH
ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	
P3IA01 006PSB	607	800	4.14	47.7	23.9	35.1	(20)	(20)	...	6.25	8.14	7.66
P3IA02 012PSB	635	700	3.26	34.2	(20)	29.8	(20)	(20)	...	1.3	9.1	7.78
P3IA03 019PSB	604	600	1.94	35.7	(20)	28.7	(20)	(20)	...	3.8	6.95	7.31
P3IA04 026PSB	578	N.D.	(2)	43.6	(20)	32.2	(20)	(20)	...	...	5	7.71
P3IA05 040PSB	574	600	2.59	44.4	20.2	29	(20)	(20)	...	...	6.38	7.35
P3IA06 047PSB	847	300	1.35	(20)	(20)	(20)	(20)	(20)	400	4.72	13.01	7.54
P3IA07 124PSB	756	200	27	(20)	(20)	20.9	(20)	(20)	...	3.88	16.9	7.78
P3IA08 131PSB	651	900	53	(20)	(20)	21.3	(20)	(20)	...	74	9	7.21
P3IA09 131PSB	755	746	...	(20)	(20)	20.4	(20)	(20)	...	...	...	7.11
P3IA10 166PSB	724	966	84	(20)	(20)	23.7	(20)	(20)	...	...	...	7.52
P3IA11 173PSB	727	508	97	(20)	(20)	27.7	(20)	(20)	400	3.54	7.12	7.47
P3IA12 187PSB	672	73	72	(20)	(20)	20.9	(20)	(20)	...	...	8	7.37
P3IA13 215PSB	667	871	1.55	(20)	(20)	26.1	(20)	(20)	400	13	79.9	7.46
P3IA14 243PSB	595	668	1.29	(20)	22.1	28.1	(20)	(20)	...	...	74	6.32
P3IA15 257PSB	594	503	57	20.4	(20)	25.3	(20)	(20)	...	...	11	7.1
P3IA16 264PSB	642	935	1.71	20.9	(20)	24.2	(20)	(20)	378	56	74.7	7.12
P3IA17 271PSB	641	718	1.46	20.9	(20)	24.9	(20)	(20)	...	...	7.45	6.38
P3IA18 285PSB	642	70	1.19	24.1	(20)	31.1	(20)	(20)	...	...	6.37	6.9
P3IA19 320PSB	575	1182	1.06	(20)	(20)	25.6	(20)	(20)	380	5	9	7.3
P3IA20 334PSB	699	866	1.06	(20)	(20)	...	(20)	(20)	...	...	...	...
P3IA21 341PSB	...	...	...	...	...	...	...	...	...	...	...	...

ABSORBER B	DIMP	DCPD	DBCP	CPMS	CPMSO	CPMSO2	DITH	OXAT	CL	F	TGC	pH
ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	
F3IB01 006PSB	105	4	3.11	(20)	27.5	(20)	(20)	(20)	...	3.51	4.02	7.33
F3IB02 012PSB	103	10	2.93	(20)	28.3	(20)	(20)	(20)	...	3.2	3.2	7.9
F3IB03 019PSB	119	8	2.41	(20)	(20)	(20)	(20)	(20)	...	3	2.62	7.51
F3IB04 026PSB	92.5	1	2.78	(20)	22.5	(20)	(20)	(20)	...	...	2	7.04
F3IB05 040PSB	105	10	1.3	(20)	31	(20)	(20)	(20)	...	...	1.59	7.43
F3IB06 047PSB	97.2	N.D.	2.28	(20)	23.5	(20)	(20)	(20)	...	...	2	7.44
F3IB07 124PSB	120	30	2.02	(20)	22.3	(20)	(20)	(20)	...	3.3	2.04	7.38
F3IB08 131PSB	131	N.D.	2.58	(20)	24.3	(20)	(20)	(20)	100	3.03	(2)	7.93
F3IB09 138PSB	117	30	2.32	(20)	23	(20)	(20)	(20)	...	2.9	...	7.34
F3IB10 166PSB	96.1	28	2.42	(20)	34.5	(20)	(20)	(20)	...	...	...	7.43
F3IB11 173PSB	108	33	2.36	(20)	28.7	(20)	(20)	(20)	...	...	...	...
F3IB12 187PSB	108	30	2.38	(20)	31.3	(20)	(20)	(20)	...	...	3.93	7.1
F3IB13 215PSB	106	N.D.	1.88	(20)	30	(20)	(20)	(20)	200	3.09	3	7.12
F3IB14 243PSB	108	41	2.38	(20)	27.7	(20)	(20)	(20)	...	...	53.8	7.51
F3IB15 257PSB	102	14	2.18	(20)	27.3	(20)	(20)	(20)	200	8	59	7.07
F3IB16 264PSB	119	30	1.33	(20)	31.4	(20)	(20)	(20)	...	...	5	7.17
F3IB17 271PSB	132	37	2.82	(20)	31.7	(20)	(20)	(20)	...	...	56.5	7.21
F3IB18 285PSB	164	38	3.49	(20)	45.3	(20)	(20)	(20)	117	48	(3)	6.74
F3IB19 320PSB	255	58	5.62	29.7	90.4	20.8	(20)	(20)	...	...	(3)	6.9
F3IB20 334PSB	244	124	5.43	24	78.7	(20)	(20)	(20)	...	...	(3)	7.3
F3IB21 341PSB	238	143	5.83	26.9	77.8	(20)	(20)	(20)	173	2.2	4	...

... = NOT ANALYZED N.D. = NOT DETECTED * = POSITIVE FOUND (= LESS THAN INDICATED CONCENTRATION

***** ANALYTE CONCENTRATION IN NORTH BOUNDARY TREATMENT PLANT INFLUENT AND EFFLUENT *****

USER SAMPLE DATE
NUMBER I.D. SAMPLE
NUMBER COLLECTED

ABSORBER C	DIMP	DCPD	DACP	CPMS	CPMSO	CPMSO2	DITH	OXAT	CL	F	TOC	pH
ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	
P3IC01 006PTB	10	N.D.	(2)	(20)	(20)	(20)	(20)	(20)	...	1.23	11.51	7.81
P3IC02 012PTB	10	N.D.	(2)	(20)	(20)	(20)	(20)	(20)	...	1.5	11.4	7.58
P3IC03 019PTB	10	N.D.	(2)	(20)	(20)	(20)	(20)	(20)	...	2.6	6.39	7.56
P3IC07 124PTB	10	N.D.	(2)	(20)	(20)	(20)	(20)	(20)	200	1.56	4.98	7.46
P3IC08 131PTB	10	N.D.	(2)	(20)	(20)	(20)	(20)	(20)	200	*	8.4	7.72
P3IC09 138PTB	18.2	N.D.	(2)	(20)	(20)	(20)	(20)	(20)	200	1.97	6	7.28
P3IC13 215PTB	10	28	(2)	(20)	(20)	(20)	(20)	(20)	200	1.87	3.47	7.16
P3IC14 243PTB	10	(1)	(2)	(20)	(20)	(20)	(20)	(20)	200	1.79	85.4	7.17
P3IC15 257PTB	10	(1)	(2)	(20)	(20)	(20)	(20)	(20)	200	...	64	7.05
P3IC16 264PTB	10	(1)	(2)	(20)	(20)	(20)	(20)	(20)	...	...	6	7.13
P3IC17 271PTB	10	(1)	(2)	(20)	(20)	(20)	(20)	(20)	161	1.86	77.7	7.2
P3IC18 285PTB	10	1	(2)	(20)	(20)	(20)	(20)	(20)	...	...	4.26	6.96
P3IC20 314PTB	10	(1)	(2)	(20)	(20)	(20)	(20)	(20)	...	...	19.4	6.89
P3IC19 320PTB	10	(1)	(2)	(20)	(20)	(20)	(20)	(20)	166	1.1	5	7.3
P3IC21 341PTB	10	(1)	(2)	(20)	(20)	(20)	(20)	(20)	...	...	...	...

EFFLUENT	DIMP	DCPD	DACP	CPMS	CPMSO	CPMSO2	DITH	OXAT	CL	F	TOC	pH
ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	
P3EX01 006PDB	14	N.D.	(2)	(20)	(20)	(20)	(20)	(20)	...	3.99	4.02	7.69
P3EX02 012PDB	10	N.D.	(2)	(20)	(20)	(20)	(20)	(20)	...	2.7	3.2	7.44
P3EX03 019PDB	22.7	N.D.	(3)	(20)	(20)	(20)	(20)	(20)	...	2.7	6.7	7.44
P3EX04 026PDB	27.6	N.D.	(2)	(20)	(20)	(20)	(20)	(20)	...	...	1	7.65
P3EX05 040PDB	39.9	N.D.	(2)	(20)	(20)	(20)	(20)	(20)	...	...	1.59	7.17
P3EX06 047PDB	126	20	(2)	(20)	(20)	(20)	(20)	(20)	...	3.22	1.03	7.45
P3EX07 124PDB	10	(10)	(2)	(20)	(20)	(20)	(20)	(20)	200	...	2	7.6
P3EX08 131PDB	10	N.D.	(2)	(20)	(20)	(20)	(20)	(20)	...	2.76	2	7.13
P3EX09 138PDB	10	10	(2)	(20)	(20)	(20)	(20)	(20)	...	5.9	...	7.17
P3EX10 166PDB	10	29	(2)	(20)	(20)	(20)	(20)	(20)	...	...	...	7.41
P3EX11 173PDB	80.8	N.D.	(2)	(20)	(20)	(20)	(20)	(20)	...	...	...	...
P3EX12 187PDB	186	62	(2)	(20)	(20)	(20)	(20)	(20)	200	2.48	5.29	7.82
P3EX13 215PDB	10	3	(2)	(20)	(20)	(20)	(20)	(20)	200	...	3	6.76
P3EX14 243PDB	10	(1)	(2)	(20)	(20)	(20)	(20)	(20)	200	2.08	80	7.48
P3EX15 257PDB	14.1	(1)	(2)	(20)	(20)	(20)	(20)	(20)	...	...	67	7.11
P3EX16 264PDB	42.2	5	(2)	(20)	(20)	(20)	(20)	(20)	...	...	3	7.22
P3EX17 271PDB	10	5	(2)	(20)	(20)	(20)	(20)	(20)	...	...	70.1	7.05
P3EX18 285PDB	32.6	9	(2)	(20)	(20)	(20)	(20)	(20)	...	...	3	6.9
P3EX19 320PDB	10	20	(2)	(20)	(20)	(20)	(20)	(20)	...	...	3.21	6.99
P3EX20 334PDB	40.6	28	(2)	(20)	(20)	(20)	(20)	(20)	...	...	...	...
P3EX21 342TSS	75.4	59	(2)	(20)	(20)	(20)	(20)	(20)	258	1.5	...	7.36
P3EX21 341PDB	75.4	59	(2)	(20)	(20)	(20)	(20)	(20)	...	...	...	...

... = NOT ANALYZED N.D. = NOT DETECTED * = POSITIVE FOUND (= LESS THAN INDICATED CONCENTRATION

***** ANALYTE CONCENTRATION IN NORTH BOUNDARY TREATMENT PLANT INFLUENT AND EFFLUENT *****

USER
SAMPLE
NUMBER

DATE
SAMPLE
COLLECTED

ABSORBER A

USER SAMPLE NUMBER	DATE SAMPLE COLLECTED	DIMP ug/l	DCPD ug/l	DBCP ug/l	CPMS ug/l	CPMSO ug/l	CPMSO2 ug/l	DITH ug/l	OXAT ug/l	CL mg/l	F mg/l	TOC mg/l	pH
P41A01	023PRB	617	643	1.33	(20	24.2	29.3	(20	(20	435	5.8	6.06	7.51
P41A02	023PRB	609	636	1.45	20.2	22.8	30	(20	(20	...	...	7.63	7.42
P41A03	032PRB	623	580	1.56	(20	23.6	25.6	(20	(20	...	...	6.79	7.06
P41A04	053PRB	614	664	1.27	(20	27.9	44.1	(20	(20	460	4.8	20	7.03
P41A05	067PRB	627	550	1.28	(20	30.2	29.9	(20	(20	...	...	8.05	7.32
P41A09	131PRB	659	482	1.18	(20	(20	(20	(20	(20	...	...	5.55	7.58
P41A10	137PRB	231	82	3	(20	(20	(20	(20	(20	...	...	3.05	7.76
P41A11	158PRB	491	354	.68	(20	(20	(20	(20	(20	...	...	7.65	7.6
P41A12	172PRB	106	16	1.74	(20	30	20	(20	(20	121	5	(3	7.52
P41A13	179PRB	104	96	.66	(20	30	20	(20	(20	...	...	3.9	7.47
P41A14	193PRB	572	268	.91	(20	(20	(20	(20	(20	...	...	5.88	7.45
P41A15	200PRB	359	225	.83	(20	(20	(20	(20	(20	...	...	8.71	7.71
P41A16	207PRB	362	413	1.29	(20	34	21.4	(20	(20	432	6	13.1	7.64
P41A17	214PRB	478	573	1.54	(20	37.7	25.2	(20	(20	...	...	10.2	7.38
P41A18	211PRB	461	512	2.12	(20	33.4	21.5	(20	(20	...	...	7.42	7.5
P41A19	228PRB	474	644	1.71	(20	30	22.2	(20	(20	...	...	20.9	7.56
P41A20	249PRB	458	50.2	1.61	(20	29	22.5	(20	(20	160	4	7.87	7.78
P41A21	256PRB	466	203	1.63	(20	27	20.3	(20	(20	...	...	(3	7.58
P41A22	270PRB	478	382	2.39	(20	33.9	24.4	(20	(20	...	...	8.81	7.39
P41A23	284PRB	467	298	1.9	(20	40	21.7	(20	(20	...	...	15.4	7.49
P41A24	287PRB	459	248	1.9	(20	42.5	23	(20	(20	...	...	12.2	7.73
P41A25	292PRB	391	300	1.9	(20	20.2	23	(20	(20	...	...	11.4	7.64
P41A26	298PRB	410	300	1.9	(20	20.2	23	(20	(20	...	...	11.4	7.64

ABSORBER B

USER SAMPLE NUMBER	DATE SAMPLE COLLECTED	DIMP ug/l	DCPD ug/l	DBCP ug/l	CPMS ug/l	CPMSO ug/l	CPMSO2 ug/l	DITH ug/l	OXAT ug/l	CL mg/l	F mg/l	TOC mg/l	pH
P41B01	023PSB	224	78	4.7	(20	93	21.9	(20	(20	174	5.1	3.2	7.66
P41B02	023PSB	242	94	5.51	25.3	87.7	(20	(20	(20	...	...	3.17	7.48
P41B03	032PSB	249	98	5.61	(20	90	(20	(20	(20	...	...	3.45	7.1
P41B04	053PSB	266	91	5.08	(20	80	(20	(20	(20	180	4.1	5	7.26
P41B05	067PSB	280	101	4.63	22	76.9	(20	(20	(20	...	...	6.41	7.42
P41B09	131PSB	116	6	1.64	(20	(20	(20	(20	(20	...	...	3.32	7.7
P41B10	137PSB	123	15	2	(20	27.6	(20	(20	(20	...	...	(3	7.56
P41B11	158PSB	122	11	1.81	(20	24.2	(20	(20	(20	...	...	5.11	7.73
P41B12	172PSB	335	504	.87	(20	(20	(20	(20	(20	360	6	(3	7.54
P41B13	179PSB	514	25	1.39	(20	30	(20	(20	(20	...	...	7	7.36
P41B15	200PSB	106	25	1.83	(20	20.4	(20	(20	(20	...	...	7.58	7.51
P41B16	207PSB	97.2	13.8	(2	(20	(20	(20	(20	(20	121	4	10.7	7.4
P41B17	214PSB	18.9	7	(2	(20	(20	(20	(20	(20	...	...	(3	7.29
P41B18	211PSB	91.3	(1	1.27	(20	(20	(20	(20	(20	...	...	3.25	7.65
P41B19	228PSB	112	6.6	2.06	(20	22.9	(20	(20	(20	...	...	3.38	7.49
P41B20	249PSB	91.6	(1	1.32	(20	(20	(20	(20	(20	...	...	17	7.57
P41B21	256PSB	88.3	(1	1.65	(20	(20	(20	(20	(20	107	4	(3	7.87
P41B22	270PSB	94.1	17	1.65	(20	(20	(20	(20	(20	...	...	(3	7.55
P41B23	277PSB	89	(1	1.42	(20	(20	(20	(20	(20	...	...	1.34	7.4
P41B24	284PSB	83.1	(1	1.42	(20	(20	(20	(20	(20	...	...	5.84	7.6
P41B25	292PSB	71.6	(1	1.82	(20	(20	(20	(20	(20	...	...	17.2	7.58
P41B26	298PSB	72.4	(1	1.34	(20	(20	(20	(20	(20	...	...	5.68	7.63

... = NOT ANALYZED N.D. = NOT DETECTED * = POSITIVE FOUND (= LESS THAN INDICATED CONCENTRATION

USER
SAMPLE
NUMBER

DATE
SAMPLE
COLLECTED

ANALYTE CONCENTRATION IN NORTH BOUNDARY TREATMENT PLANT INFLUENT AND EFFLUENT

ABSORBER C

USER SAMPLE NUMBER	DATE SAMPLE COLLECTED	DIMP ug/l	DCPD ug/l	DBCP ug/l	CPHS ug/l	CPHSO ug/l	CPHSO2 ug/l	DITH ug/l	OXAT ug/l	CL mg/l	F mg/l	TOC mg/l	pH
P4IC01	023PTB	110	(1)	(2)	(20)	(20)	(20)	(20)	(20)	174	1.72	6.58	7.63
P4IC02	023PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.47
P4IC03	032PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.25
P4IC04	053PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.36
P4IC05	067PTB	(13)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.87
P4IC06	082PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.5
P4IC07	093PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.6
P4IC08	131PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.51
P4IC09	137PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.44
P4IC10	158PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.44
P4IC11	179PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.44
P4IC12	200PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.44
P4IC13	207PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.44
P4IC14	214PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.44
P4IC15	214PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.44
P4IC16	214PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.44
P4IC17	214PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.44
P4IC18	214PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.44
P4IC19	214PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.44
P4IC20	214PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.44
P4IC21	214PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.44
P4IC22	214PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.44
P4IC23	214PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.44
P4IC24	214PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.44
P4IC25	214PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.44

EFFLUENT

USER SAMPLE NUMBER	DATE SAMPLE COLLECTED	DIMP ug/l	DCPD ug/l	DBCP ug/l	CPHS ug/l	CPHSO ug/l	CPHSO2 ug/l	DITH ug/l	OXAT ug/l	CL mg/l	F mg/l	TOC mg/l	pH
P4EX02	033PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.47
P4EX03	033PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.25
P4EX04	053PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.36
P4EX05	067PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.87
P4EX06	082PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.5
P4EX07	093PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.6
P4EX08	131PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.51
P4EX09	137PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.44
P4EX10	158PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.44
P4EX11	179PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.44
P4EX12	200PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.44
P4EX13	207PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.44
P4EX14	214PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.44
P4EX15	214PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.44
P4EX16	214PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.44
P4EX17	214PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.44
P4EX18	214PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.44
P4EX19	214PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.44
P4EX20	214PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.44
P4EX21	214PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.44
P4EX22	214PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.44
P4EX23	214PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.44
P4EX24	214PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.44
P4EX25	214PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.44
P4EX26	214PTB	(10)	(1)	(2)	(20)	(20)	(20)	(20)	(20)	(158)	1.78	5.12	7.44

NOT ANALYZED N.D. = NOT DETECTED * = POSITIVE FOUND (= LESS THAN INDICATED CONCENTRATION

APPENDIX E: ANALYTE CONCENTRATIONS IN NORTH BOUNDARY DEWATERING WELLS

USER
SAMPLE
NUMBER

DATE
SAMPLE
COLLECTED

ANALYTE CONCENTRATION IN NORTH BOUNDARY DEWATERING WELLS

DEWATERING WELL #01

DEWATERING WELL #01	DIMP	DCPD	DBCP	CPMS	CPMSO	CPMSO2	DITH	OXAT	CL	F	TOC	pH
P20101 019DA7 19 JAN 82	662 *	...	(.2	...	...	...	...	...	...	4.2 *	...	...
P20102 125DA7 5 MAY 82	743 *	...	(.2	...	...	...	...	...	...	4.5 *	...	...
P20103 193DA7 12 JUL 82	653 *	2 *	(.2	(20	(20	(20	53.2 *	(20	...	5 *	4.6 *	8.25 *
P20104 292DA7 19 OCT 82	727 *	N.D.	(.2	(20	(20	(20	21.7 *	(20	...	4.0 *	5.8 *	7.55 *
P30101 019DA7 19 JAN 83	716 *	1 *	(.2	(20	(20	(20	(20	(20	...	4.7 *	4.1 *	7.13 *
P30102 110DA7 20 APR 83	941 *	N.D.	(.2	(20	(20	(20	(20	(20	300 *	4.95 *	4.5 *	7.22 *
P30103 214DA7 2 AUG 83	816 *	N.D.	(.2	(20	(20	(20	(20	(20	300 *	3.99 *	6.2 *	6.97 *
P40101 172DA7 20 JUN 84	215 *	(1	(.2	(20	(20	(20	(20	(20	230 *	7 *	(3	7.83 *

DEWATERING WELL #02

DEWATERING WELL #02	DIMP	DCPD	DBCP	CPMS	CPMSO	CPMSO2	DITH	OXAT	CL	F	TOC	pH
P20201 019DA8 19 JAN 82	2090 *	...	(.2	...	...	...	...	...	...	3.3 *	...	...
P20202 125DA8 5 MAY 82	1400 *	...	(.2	...	...	...	...	...	...	3.5 *	...	...
P20203 193DA8 12 JUL 82	1810 *	8 *	(.2	(20	(20	(20	52.1 *	(20	...	4 *	5.0 *	7.91 *
P20204 292DA8 19 OCT 82	1220 *	100 *	(.2	(20	(20	(20	46.6 *	(20	...	3.6 *	6.3 *	7.15 *
P30201 025DA8 25 JAN 83	1500 *	2 *	(.2	(20	(20	(20	(20	(20	...	3.9 *	4 *	7.99 *
P30202 110DA8 20 APR 83	1480 *	200 *	(.2	(20	(20	(20	40.1 *	(20	400 *	3.3 *	8.8 *	7.26 *
P30203 214DA8 2 AUG 83	1420 *	N.D.	(.2	(20	(20	(20	(20	(20	400 *	3.42 *	5.29 *	7.03 *
P40201 172DA8 20 JUN 84	1730 *	14 *	(.2	(20	(20	(20	(20	(20	532 *	3.3 *	(3	7.5 *

DEWATERING WELL #03

DEWATERING WELL #03	DIMP	DCPD	DBCP	CPMS	CPMSO	CPMSO2	DITH	OXAT	CL	F	TOC	pH
P20301 019DA9 19 JAN 82	1790 *	...	(.2	...	...	...	...	...	...	3.5 *	...	...
P20302 125DA9 5 MAY 82	2110 *	...	(.2	...	...	...	...	...	...	3 *	...	...
P20303 193DA9 12 JUL 82	237 *	N.D.	(.2	(20	(20	(20	29.2 *	(20	...	4 *	5.4 *	8.33 *
P20304 292DA9 19 OCT 82	1077 *	N.D.	(.2	(20	(20	(20	47.4 *	(20	...	3.6 *	8 *	7.43 *
P30301 019DA9 19 JAN 83	835 *	300 *	.32 *	(20	(20	(20	34.7 *	(20	...	3.7 *	12.03 *	7.32 *
P30302 110DA9 20 APR 83	2320 *	N.D.	(.2	(20	(20	(20	(20	(20	500 *	2.82 *	0.3 *	7.05 *
P30303 214DA9 2 AUG 83	1530 *	...	(.2	(20	(20	(20	30 *	(20	...	3.17 *	5.29 *	7.04 *
P40301 172DA9 20 JUN 84	1150 *	6 *	(.2	(20	(20	(20	30 *	(20	420 *	6 *	(3	7.6 *

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USER
SAMPLE
NUMBER

DATE
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***** ANALYTE CONCENTRATION IN NORTH BOUNDARY DEWATERING WELLS *****

DEWATERING WELL #04

	DIMP	DCPD	DBCP	CPMS	CPMSO	CPMSO2	DITH	OXAT	CL	F	TOC	pH
	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	
P20401	810		(.2							4.8		
P20402	808		(.2							4.5	6.6	8.86
P20403	949	500		(20	(20	24.9	28.7	(20		4.5	6.9	7.53
P20404	780	600	(.2	(20	(20	27.6	23.1	(20		4.1	8.99	7.32
P30401	926	500	(.2	(20	(20	20.9	20.5	(20		4.7	12.9	7.39
P30402	801	1000	(.2	(20	(20	24.5	30	(20	400	4.32	24.3	7.23
P30403	796		.32	(20	(20	31.8	30	(20	500	4.2	15	7.96
P40401	891	1260	(.2	(20	(20	40	20	(20	590	5		

DEWATERING WELL #05

	DIMP	DCPD	DBCP	CPMS	CPMSO	CPMSO2	DITH	OXAT	CL	F	TOC	pH
	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	
P20501	564		.29							4		
P20502	654		.29							3.5	12.4	7.9
P20503	81.2	2000	.58	(20	(20	32.8	25.7	(20		3.5	13	7.30
P20504	566	3000	.37	(20	(20	39.2	20	(20		3.4	14.03	7.24
P30501	627	2000	.44	(20	(20	39.7	20	(20	600	2.05	7.6	7.16
P30502	76.7	2000	.50	(20	(20	51.2	20	(20	400	3.4	9.86	7.37
P30503	586		4.33	64.2	80	50	20	(20	410	5	8.53	7.56
P40501	438	333										

DEWATERING WELL #06

	DIMP	DCPD	DBCP	CPMS	CPMSO	CPMSO2	DITH	OXAT	CL	F	TOC	pH
	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	
P20601	567		.72							3.4		
P20602	579		1.38							3.5	10.7	7.90
P20603	755	1000	5.84	34.5	(20	60.1	21.5	(20		3.5	10.1	7.4
P20604	466	1000	5.29	106	57.2	56.9	20	(20		3.2	13.15	7.4
P30601	407	500	8.49	122	48.2	44.2	20	(20	300	3.6	5.6	7.16
P30602	363	900	8.34	126	35.2	35.1	20	(20	200	3.3	6.2	7.37
P30603	258			109	(20	28.5	20	(20				
P40601		115										

DEWATERING WELL #07

	DIMP	DCPD	DBCP	CPMS	CPMSO	CPMSO2	DITH	OXAT	CL	F	TOC	pH
	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	
P20701	484		1.54							3.3		
P20702	410		8.59							3.5	6.2	8.29
P20703	422	300		180	(20	49	20	(20		4.1	6.1	7.3
P20704	302	300	.42	196	(20	43.2	20	(20		3.9	5.6	7.04
P30701	320	300	7.67	146	(20	48.5	20	(20	300	3.6	5.2	7.16
P30702	275	N.D.	9.2	117	64.4	33.7	20	(20	200	3.4	10.0	7.67
P30703	307		9.09	64.5	78.1	33.3	20	(20	164	6		
P40701	249	91	4.40	24.5	00	(20	20	(20				

..... = NOT ANALYZED N.D. = NOT DETECTED * = POSITIVE FOUND (= LESS THAN INDICATED CONCENTRATION

USER USER DATE
SAMPLE I.D. SAMPLE
NUMBER NUMBER COLLECTED

***** ANALYTE CONCENTRATION IN NORTH BOUNDARY DEWATERING WELLS *****

DEWATERING WELL #08	DIMP	DCPD	DRCP	CPHS	CPHSO	CPHSO2	DITH	OXAT	CL	F	TOC	pH
P20801 019DR2 19 JAN 82	393	*	21	*	*	*	*	*	*	3.2	*	*
P20802 125DR2 5 MAY 82	371	*	14.6	*	*	*	*	*	*	3.5	*	*
P20803 193DR2 12 JUL 82	393	*	*	114	56.8	48.4	(20)	(20)	200	3.5	5.4	7.87
P30802 110DR2 20 APR 83	239	*	18	60.1	145	29.4	(20)	(20)	200	3.15	4.4	7.43
P40801 172DR2 20 JUN 84	199	42	5.41	(20)	70	(20)	(20)	(20)	132	6	8.53	8.62
DEWATERING WELL #09	DIMP	DCPD	DRCP	CPHS	CPHSO	CPHSO2	DITH	OXAT	CL	F	TOC	pH
P20901 019DBE 19 JAN 82	340	*	29.7	*	*	*	*	*	*	3.3	*	*
P20902 125DR3 5 MAY 82	307	*	23.4	*	*	*	*	*	*	2.5	4.5	8
P20903 193DR3 12 JUL 82	276	50	*	50.2	186	30.6	(20)	(20)	200	3	5.8	7.30
P20904 292DR1 19 OCT 82	229	60	7.48	54.6	200	30	(20)	(20)	200	3.3	2.62	7.46
P30901 019DB3 19 JAN 83	218	N.D.	6.81	23.3	113	(20)	(20)	(20)	200	2.9	4	7.27
P30902 110DR3 20 APR 83	242	40	0.83	(20)	96.4	(20)	(20)	(20)	200	2.66	5.06	7.52
P30903 222DR3 10 AUG 83	197	16	5.71	(20)	81.1	(20)	(20)	(20)	200	3	5.95	7.72
P40901 172DR3 20 JUN 84	152	13	1.79	(20)	(20)	(20)	(20)	(20)	109	2.9	*	*
DEWATERING WELL #10	DIMP	DCPD	DRCP	CPHS	CPHSO	CPHSO2	DITH	OXAT	CL	F	TOC	pH
P21001 019DR4 19 JAN 82	341	*	32.8	*	*	*	*	*	*	2.7	*	*
P21002 125DR4 5 MAY 82	249	*	15.8	*	*	*	*	*	*	2.5	4.2	8.38
P21003 193DR4 12 JUL 82	325	10	29.2	117	90	(20)	(20)	(20)	200	2.82	4.4	7.79
P31002 110DR4 20 APR 83	220	100	0.54	45.9	70	20.8	(20)	(20)	150	2.7	7.88	7.61
P41001 172DR4 20 JUN 84	205	22	6.29	(20)	(20)	(20)	(20)	(20)	109	2.9	*	*
DEWATERING WELL #11	DIMP	DCPD	DRCP	CPHS	CPHSO	CPHSO2	DITH	OXAT	CL	F	TOC	pH
P21101 019DB5 19 JAN 82	240	*	19.6	*	*	*	*	*	*	2.6	*	*
P21102 125DB5 5 MAY 82	227	*	6.67	*	*	*	*	*	*	2.5	4.6	8.37
P21103 193DB5 12 JUL 82	204	2	*	(20)	61.9	(20)	(20)	(20)	200	3	4.7	7.19
P21104 292DB4 19 OCT 82	195	2	3.3	(20)	83.2	(20)	(20)	(20)	200	2.9	2.16	7.77
P31101 019DB5 19 JAN 83	87.3	N.D.	2.35	(20)	47.3	(20)	(20)	(20)	100	3.1	4.4	7.20
P31102 110DB5 20 APR 83	199	N.D.	3.15	(20)	29	(20)	(20)	(20)	100	2.7	5.66	7.48
P31103 222DB5 10 AUG 83	181	6	2.91	(20)	33.5	(20)	(20)	(20)	100	3	8.2	7.62
P41101 172DB5 20 JUN 84	130	3	2.94	(20)	30	(20)	(20)	(20)	120	3.1	*	*

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ANALYTE CONCENTRATION IN NORTH BOUNDARY DEWATERING WELLS

DEWATERING WELL #12

DEWATERING WELL #12	DIMP	DCPD	DBCP	CPMS	CPMSO	CPMSO2	DITH	OXAL	CL	F	TOC	pH
P21201 019086 19 JAN 82	224 *	...	9.14 *	...	...	...	...	...	...	2.6 *	...	...
P21202 125086 5 MAY 82	212 *	N.D.	3.99 *	46 *	...	...	...	...	...	2.5 *	...	...
P21203 193086 12 JUL 82	226 *	...	...	...	...	...	...	...	...	2.5 *	...	...
P41201 172086 20 JUN 84	84.9 *	(1	1.30 *	...	...	...	...	...	97.8 *	3.2 *	4.2 *	7.07 *
											6.56 *	7.52 *

DEWATERING WELL #13

DEWATERING WELL #13	DIMP	DCPD	DBCP	CPMS	CPMSO	CPMSO2	DITH	OXAL	CL	F	TOC	pH
P21301 019087 19 JAN 82	224 *	...	7.51 *	...	...	...	...	...	...	2.6 *	...	...
P21302 125087 5 MAY 82	186 *	...	5.27 *	...	...	...	...	...	...	2.5 *	...	...
P21303 193087 12 JUL 82	207 *	N.D.	3.53 *	42 *	...	...	...	...	...	2.5 *	4.6 *	7.9 *
P21304 292085 19 OCT 82	118 *	N.D.	95 *	...	...	...	...	...	...	3 *	3.6 *	7.10 *
P31301 019087 19 JAN 83	163 *	N.D.	2.17 *	24.4 *	...	...	...	...	...	3 *	2.5 *	7.4 *
P31302 110087 20 APR 83	153 *	N.D.	2.31 *	22.2 *	...	...	...	...	100 *	2.62 *	4.4 *	7.20 *
P31303 222087 10 AUG 83	128 *	N.D.	1.04 *	26.1 *	...	...	...	...	100 *	3 *	6.55 *	7.51 *

DEWATERING WELL #14

DEWATERING WELL #14	DIMP	DCPD	DBCP	CPMS	CPMSO	CPMSO2	DITH	OXAL	CL	F	TOC	pH
P21401 026088 26 JAN 82	194 *	...	3.25 *	...	...	...	...	...	...	2.9 *	...	...
P21402 144088 24 MAY 82	166 *	...	1.06 *	...	...	...	...	...	...	3 *	4.6 *	8.22 *
P21403 193088 12 JUL 82	147 *	N.D.	94 *	...	...	...	...	...	...	3 *	2.2 *	7.44 *
P21404 292087 19 OCT 82	103 *	N.D.	9 *	...	...	...	...	...	...	2.9 *	4 *	7.22 *
P31401 025088 25 JAN 83	104 *	N.D.	37 *	...	...	...	...	...	...	3.3 *	3.4 *	7.23 *
P31402 110088 20 APR 83	139 *	N.D.	1.19 *	...	...	...	...	...	100 *	3.11 *	6 *	7.65 *
P41401 179088 27 JUN 84	64.4 *	...	47 *	...	...	...	...	...	115 *	4 *	...	...

DEWATERING WELL #15

DEWATERING WELL #15	DIMP	DCPD	DBCP	CPMS	CPMSO	CPMSO2	DITH	OXAL	CL	F	TOC	pH
P21501 019089 19 JAN 82	125 *	...	1.17 *	...	...	...	...	...	...	3.1 *	...	...
P21502 144089 24 MAY 82	97.3 *	...	52 *	...	...	...	...	...	...	3 *	4.6 *	9.22 *
P21503 193089 12 JUL 82	67.8 *	N.D.	2 *	...	...	...	...	...	...	3 *	2 *	7.02 *
P21504 292089 19 OCT 82	64.3 *	N.D.	42 *	...	...	...	...	...	...	2.9 *	2.39 *	7.22 *
P31501 019089 19 JAN 83	83.7 *	N.D.	9 *	...	...	...	...	...	...	5.2 *	4 *	7.23 *
P31502 110089 20 APR 83	58 *	N.D.	49 *	...	...	...	...	...	100 *	3.29 *	5.96 *	7.55 *
P31503 222089 10 AUG 83	74.7 *	N.D.	86 *	100 *	30 *	8 *	7.48 *
P41501 179089 27 JUN 84	48.8 *	...	24 *	112 *	4 *

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ANALYTE CONCENTRATION IN NORTH BOUNDARY DEWATERING WELLS

DEWATERING WELL #16		DIMP	DCPD	DBCP	CPHS	CPMSO	CPMSO2	DITH	OXAI	CL	F	TOC	pH
USER SAMPLE NUMBER	DATE SAMPLE COLLECTED	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	
P21601	019DBA 19 JAN 82	65.9 *	...	39 *	...	...	...	...	...	...	2.2 *	...	...
P21602	144DBA 24 MAY 82	58.8 *	N.D.	(.2)	(20)	(20)	(20)	(20)	(20)	...	3.5 *	4.2 *	8.33 *
P21603	193DBA 12 JUL 82	51.7 *	N.D.	(.2)	(20)	(20)	(20)	(20)	(20)	...	3.5 *	3.1 *	7.39 *
P21604	292DBA 19 OCT 82	33.1 *	N.D.	(.2)	(20)	(20)	(20)	(20)	(20)	...	3.3 *	2 *	7.8 *
P31601	025DBA 25 JAN 83	57.2 *	N.D.	55 *	(20)	(20)	(20)	(20)	(20)	100 *	3.3 *	4.4 *	7.28 *
P31602	110DBA 20 APR 83	35.9 *	N.D.	21 *	(20)	(20)	(20)	(20)	(20)	100 *	3.25 *	5.06 *	7.44 *
P31603	222DBA 10 AUG 83	30.0 *	N.D.	3 *	(20)	(20)	(20)	(20)	(20)	113 *	5 *	...	7.61 *
P41601	172DBA 20 JUN 84	30.4 *	(1)	23 *	(20)	(20)	(20)	(20)	(20)	...	...	...	...
DEWATERING WELL #17		DIMP	DCPD	DBCP	CPHS	CPMSO	CPMSO2	DITH	OXAI	CL	F	TOC	pH
USER SAMPLE NUMBER	DATE SAMPLE COLLECTED	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	
P21701	019DBA 19 JAN 82	41.6 *	...	22 *	...	...	...	...	...	...	3.2 *	...	...
P21702	125DBA 5 MAY 82	31.7 *	N.D.	(.2)	(20)	(20)	(20)	(20)	(20)	...	3 *	4.2 *	0.11 *
P21703	193DBA 12 JUL 82	25.8 *	N.D.	(.2)	(20)	(20)	(20)	(20)	(20)	...	2.9 *	(2)	7.19 *
P21704	292DBA 19 OCT 82	30.5 *	N.D.	39 *	(20)	(20)	(20)	(20)	(20)	...	3.3 *	2.16 *	7.14 *
P31701	019DBA 19 JAN 83	23.6 *	N.D.	55 *	(20)	(20)	(20)	(20)	(20)	100 *	3.3 *	5.3 *	7.19 *
P31702	110DBA 20 APR 83	22.8 *	N.D.	26 *	(20)	(20)	(20)	(20)	(20)	100 *	2.86 *	...	7.61 *
P31703	222DBA 10 AUG 83	27.7 *	N.D.	(.2)	(20)	(20)	(20)	(20)	(20)	...	3 *	5.66 *	...
DEWATERING WELL #18		DIMP	DCPD	DBCP	CPHS	CPMSO	CPMSO2	DITH	OXAI	CL	F	TOC	pH
USER SAMPLE NUMBER	DATE SAMPLE COLLECTED	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	
P21801	019DBA 19 JAN 82	29.1 *	...	(.2)	...	...	...	...	...	...	2.5 *	...	...
P21802	145DBA 25 MAY 82	41.9 *	6 *	35 *	(20)	(20)	(20)	(20)	(20)	...	2 *	5 *	8.59 *
P21803	193DBA 12 JUL 82	25.2 *	(1)	43 *	(20)	(20)	(20)	(20)	(20)	91 *	2.4 *	(3)	7.51 *
P41801	172DBA 20 JUN 84	25.2 *	...	28 *	(20)	(20)	(20)	(20)	(20)	...	...	...	...
DEWATERING WELL #19		DIMP	DCPD	DBCP	CPHS	CPMSO	CPMSO2	DITH	OXAI	CL	F	TOC	pH
USER SAMPLE NUMBER	DATE SAMPLE COLLECTED	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	
P21904	292DBA 19 OCT 82	21.6 *	N.D.	23 *	(20)	(20)	(20)	(20)	(20)	...	2 *	4 *	7.44 *
P31902	117DBA 27 APR 83	21.4 *	...	2 *	(20)	(20)	(20)	(20)	(20)	7.63 *

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ANALYTE CONCENTRATION IN NORTH BOUNDARY DEWATERING WELLS

DEWATERING WELL #20

WELL	DATE	DIMP	DCPD	DRCP	CPMS	CPMSO	CPMSO2	DITH	OXAT	CL	F	TOC	pH
P22001	02JDC2	26 JAN 82	14.2 *	1.10 *	(20)	(20)	(20)	(20)	(20)	(20)	1.8 *	(20)	(20)
P22002	125DC9	5 MAY 82	23.6 *	(2)	(20)	(20)	(20)	(20)	(20)	(20)	1.5 *	5	7.72 *
P22003	193DC2	12 JUL 82	22.8 *	44 *	(20)	(20)	(20)	(20)	(20)	(20)	1.5 *	5	7.63 *
P22004	292DC2	19 OCT 82	N.D.	(2)	(20)	(20)	(20)	(20)	(20)	(20)	1.7 *	2.96 *	7.36 *
P32001	019DC2	19 JAN 83	N.D.	(2)	(20)	(20)	(20)	(20)	(20)	100 *	1.2 *	5.3 *	7.54 *
P32002	110DC2	20 APR 83	N.D.	(2)	(20)	(20)	(20)	(20)	(20)	100 *	1 *	6.55 *	7.49 *
P32003	222DC2	10 AUG 83	N.D.	(2)	(20)	(20)	(20)	(20)	(20)	112 *	1.4 *	8	7.39 *
P42001	179DC2	27 JUN 84	23.6 *	(2)	(20)	(20)	(20)	(20)	(20)	(20)	(20)	(20)	(20)

DEWATERING WELL #21

WELL	DATE	DIMP	DCPD	DRCP	CPMS	CPMSO	CPMSO2	DITH	OXAT	CL	F	TOC	pH
P22101	019DC2	19 JAN 82	24.7 *	(2)	(20)	(20)	(20)	(20)	(20)	(20)	1.89 *	(20)	(20)
P22102	125DC3	5 MAY 82	21.5 *	(2)	(20)	(20)	(20)	(20)	(20)	(20)	2 *	5.4 *	8.12 *
P22103	193DC3	12 JUL 82	26.2 *	(2)	(20)	(20)	(20)	(20)	(20)	(20)	1 *	4	7.4 *
P22104	292DC3	19 OCT 82	17.8 *	(2)	(20)	(20)	(20)	(20)	(20)	(20)	1.4 *	2.62 *	7.34 *
P32101	019DC3	19 JAN 83	18.9 *	(2)	(20)	(20)	(20)	(20)	(20)	100 *	1.1 *	5.0 *	7.27 *
P32102	110DC3	20 APR 83	15 *	(2)	(20)	(20)	(20)	(20)	(20)	100 *	1 *	5.96 *	7.57 *
P32103	222DC3	10 AUG 83	16.1 *	(2)	(20)	(20)	(20)	(20)	(20)	100 *	1.2 *	8	7.53 *
P42101	179DC3	27 JUN 84	17.1 *	24 *	(20)	(20)	(20)	(20)	(20)	(20)	(20)	(20)	(20)

DEWATERING WELL #22

WELL	DATE	DIMP	DCPD	DRCP	CPMS	CPMSO	CPMSO2	DITH	OXAT	CL	F	TOC	pH
P22201	019DC2	19 JAN 82	25 *	(2)	(20)	(20)	(20)	(20)	(20)	(20)	1.9 *	(20)	(20)
P22202	125DC4	5 MAY 82	24.1 *	(2)	(20)	(20)	(20)	(20)	(20)	(20)	2 *	4.6 *	7.87 *
P22203	193DC4	12 JUL 82	10 *	(2)	(20)	(20)	(20)	(20)	(20)	(20)	1 *	2.39 *	7.33 *
P32201	019DC4	19 JAN 83	19.7 *	(2)	(20)	(20)	(20)	(20)	(20)	100 *	1.3 *	4.9 *	7.19 *
P32202	110DC4	20 APR 83	18.8 *	(2)	(20)	(20)	(20)	(20)	(20)	100 *	1.06 *	6.25 *	7.51 *
P32203	222DC4	10 AUG 83	18.2 *	(2)	(20)	(20)	(20)	(20)	(20)	112 *	1.3 *	8	7.46 *
P42201	179DC4	27 JUN 84	16.3 *	(2)	(20)	(20)	(20)	(20)	(20)	(20)	(20)	(20)	(20)

DEWATERING WELL #23

WELL	DATE	DIMP	DCPD	DRCP	CPMS	CPMSO	CPMSO2	DITH	OXAT	CL	F	TOC	pH
P22301	019DC3	19 JAN 82	17.1 *	(2)	(20)	(20)	(20)	(20)	(20)	(20)	1.4 *	(20)	(20)
P22302	125DC5	5 MAY 82	18.6 *	(2)	(20)	(20)	(20)	(20)	(20)	(20)	1.5 *	5	7.91 *
P22303	193DC5	12 JUL 82	20.7 *	(2)	(20)	(20)	(20)	(20)	(20)	(20)	1.5 *	4.5 *	7.21 *
P32302	110DC5	20 APR 83	14.6 *	(2)	(20)	(20)	(20)	(20)	(20)	100 *	1.31 *	5.66 *	7.57 *
P32303	222DC5	10 AUG 83	15.3 *	(2)	(20)	(20)	(20)	(20)	(20)	100 *	1 *	(20)	(20)

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***** ANALYTE CONCENTRATION IN NORTH BOUNDARY DEWATERING WELLS *****

DEWATERING WELL #24

	DIMP	DCPD	DRCP	CPHS	CPHSO	CPHSO2	DITH	OXAT	CL	F	IOC	pH
	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	mg/l	mg/l	mg/l	
P22401	026DC8 26 JAN 82	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10
P22402	125DC6 5 MAY 82	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10
P22403	193DC6 12 JUL 82	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10
P32401	019DC6 19 JAN 83	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10
P32402	20 APR 83	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10
P32403	222DC6 10 AUG 83	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10
P42401	179DC6 27 JUN 84	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10

DEWATERING WELL #25

	DIMP	DCPD	DRCP	CPHS	CPHSO	CPHSO2	DITH	OXAT	CL	F	IOC	pH
	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	mg/l	mg/l	mg/l	
P22501	019DC6 19 JAN 82	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10
P22502	125DC7 5 MAY 82	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10
P22503	193DC7 12 JUL 82	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10
P32501	019DC7 19 JAN 83	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10
P32502	110DC7 20 APR 83	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10
P32503	222DC7 10 AUG 83	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10
P42501	179DC7 27 JUN 84	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10

DEWATERING WELL #26

	DIMP	DCPD	DRCP	CPHS	CPHSO	CPHSO2	DITH	OXAT	CL	F	IOC	pH
	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	mg/l	mg/l	mg/l	
P22601	026DC8 26 JAN 82	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10
P22602	125DC8 5 MAY 82	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10
P22603	193DC8 12 JUL 82	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10
P32601	019DC8 19 JAN 83	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10
P32602	117DC8 27 APR 83	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10
P32603	229DC8 17 AUG 83	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10
P42601	179DC8 27 JUN 84	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10

DEWATERING WELL #27

	DIMP	DCPD	DRCP	CPHS	CPHSO	CPHSO2	DITH	OXAT	CL	F	IOC	pH
	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	mg/l	mg/l	mg/l	
P22701	026DC9 26 JAN 82	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10
P22702	125DC9 5 MAY 82	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10
P22703	193DC9 12 JUL 82	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10
P32701	019DC9 19 JAN 83	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10
P32702	117DC9 27 APR 83	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10
P32703	229DC9 17 AUG 83	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10
P42701	179DC9 27 JUN 84	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10	(10

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***** ANALYTE CONCENTRATION IN NORTH BOUNDARY DEWATERING WELLS *****

DEWATERING WELL #28

DEWATERING WELL #28	DIMP ug/l	DCPD ug/l	DACP ug/l	CPHS ug/l	CPHSO ug/l	CPHSO2 ug/l	DITH ug/l	OXAT ug/l	CL mg/l	F mg/l	TOC mg/l	pH
P22801 0260CA 26 JAN 82	10		(.2)							1.7		
P22802 1440CA 24 MAY 82	10		(.2)							1.5		
P22803 1930CA 12 JUL 82	10	2	(.2)							1.5	6.2	8.66
P32801 0190CA 19 JAN 83	10	N.D.	(.2)	(20)	(20)	(20)	(20)	(20)		2.3	6.30	7.35
P32802 1170CA 27 APR 83	10		(.2)	(20)	(20)	(20)	(20)	(20)				6.77
P32803 2290CA 17 AUG 83	10	N.D.	(.2)	(20)	(20)	(20)	(20)	(20)	200	2.17	20	7.73
P42801 1790CA 27 JUN 84	10	(1)	(.2)	(20)	(20)	(20)	(20)	(20)	97.9	2.1	(3)	7.42

DEWATERING WELL #29

DEWATERING WELL #29	DIMP ug/l	DCPD ug/l	DACP ug/l	CPHS ug/l	CPHSO ug/l	CPHSO2 ug/l	DITH ug/l	OXAT ug/l	CL mg/l	F mg/l	TOC mg/l	pH
P22901 0260CB 26 JAN 82	10		(.2)							1.5		
P22902 1440CB 24 MAY 82	10		(.2)							1.5		
P22903 2010CB 20 JUL 82	10	N.D.	(.2)	(20)	(20)	(20)	(20)	(20)		1.1	8.2	7.41
P32901 0190CB 19 JAN 83	10	N.D.	(.2)	(20)	(20)	(20)	(20)	(20)			8.65	7.07
P32902 1170CB 27 APR 83	11.3		(.2)	(20)	(20)	(20)	(20)	(20)				6.77
P32903 2290CB 17 AUG 83	10	N.D.	(.2)	(20)	(20)	(20)	(20)	(20)	400	1.3	20	7.79
P42901 1790CB 27 JUN 84	10	(1)	(.2)	(20)	(20)	(20)	(20)	(20)	95.7	1.4	11.8	7.22

DEWATERING WELL #30

DEWATERING WELL #30	DIMP ug/l	DCPD ug/l	DACP ug/l	CPHS ug/l	CPHSO ug/l	CPHSO2 ug/l	DITH ug/l	OXAT ug/l	CL mg/l	F mg/l	TOC mg/l	pH
P23001 0260A1 26 JAN 82	189		(.2)							17		
P23002 0320A1 1 FEB 82			(.2)							5.6		
P23003 1250A1 5 MAY 82	104		(.2)							5.5		
P23004 2010A1 20 JUL 82	34	N.D.	(.2)	(20)	(20)	(20)	(20)	(20)		5	8.4	7.96
P33001 0190A1 19 OCT 82	18.8	N.D.	(.2)	(20)	(20)	(20)	(20)	(20)		5	3.8	7.69
P33002 1100A1 19 JAN 83	12.1	N.D.	(.2)	(20)	(20)	(20)	(20)	(20)		5.2	2.39	7.77
P33003 2140A1 20 APR 83	10	N.D.	(.2)	(20)	(20)	(20)	(20)	(20)	400	5.4	5.3	7.45
P43001 1720A1 2 AUG 83	11.3	N.D.	(.2)	(20)	(20)	(20)	(20)	(20)	300	4.5	3.93	7.53
P43002 1720A1 20 JUN 84	10.8	(1)	(.2)	(20)	(20)	(20)	(20)	(20)	204	7	(3)	7.80

DEWATERING WELL #31

DEWATERING WELL #31	DIMP ug/l	DCPD ug/l	DACP ug/l	CPHS ug/l	CPHSO ug/l	CPHSO2 ug/l	DITH ug/l	OXAT ug/l	CL mg/l	F mg/l	TOC mg/l	pH
P23101 0190A2 19 JAN 82	220		(.2)							5.6		
P23102 1450A2 25 MAY 82	152		(.2)							5		
P23103 2920A2 19 OCT 82	74	N.D.	(.2)	(20)	(20)	(20)	(20)	(20)		5	3.2	7.8
P33101 0250A2 25 JAN 83	20.5	N.D.	(.2)	(20)	(20)	(20)	(20)	(20)		4.7	1	8.55
P43101 1720A2 20 JUN 84	33.8	(1)	(.2)	(20)	(20)	(20)	(20)	(20)	224	7	(3)	7.82

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***** ANALYTE CONCENTRATION IN NORTH BOUNDARY DEWATERING WELLS *****

DEWATERING WELL #32

DEWATERING WELL #32	DIMP	DCPD	DBCP	CPHS	CPHSO	CPHSO2	DITH	OXAT	CL	F	TOC	pH
P23201 019DA3 19 JAN 82	329 *	...	(.2	...	...	...	...	...	...	5.6 *	...	...
P23202 125DA3 5 MAY 82	334 *	...	(.2	...	...	...	...	...	...	5.5 *	...	...
P23203 201DA3 20 JUL 82	262 *	N.D.	(.2	(20	(20	(20	(20	(20	...	5.5 *	4.4 *	8.22 *
P23204 292DA3 19 OCT 82	257 *	N.D.	(.2	(20	(20	(20	(20	(20	...	5.5 *	3.2 *	7.60 *
P23201 025DA3 25 JAN 83	259 *	N.D.	(.2	(20	(20	(20	(20	(20	...	5.5 *	1 *	8.16 *
P23202 110DA3 20 APR 83	300 *	N.D.	(.2	(20	(20	(20	(20	(20	200 *	5.55 *	4.9 *	7.47 *
P23203 214DA3 2 AUG 83	293 *	N.D.	(.2	(20	(20	(20	(20	(20	200 *	4.6 *	3.93 *	7.49 *
P23201 172DA3 20 JUN 84	208 *	(1	(.2	(20	(20	(20	(20	(20	200 *	7 *	3.96 *	7.85 *

DEWATERING WELL #33

DEWATERING WELL #33	DIMP	DCPD	DBCP	CPHS	CPHSO	CPHSO2	DITH	OXAT	CL	F	TOC	pH
P23301 019DA4 19 JAN 82	465 *	...	(.2	...	...	...	...	...	...	5.6 *	...	...
P23302 125DA4 5 MAY 82	479 *	...	(.2	...	...	...	...	...	...	6 *	...	...
P23303 201DA4 20 JUL 82	620 *	N.D.	(.2	(20	(20	(20	(20	(20	...	5.5 *	3.4 *	8.23 *
P23305 292DA4 19 OCT 82	396 *	N.D.	(.2	(20	(20	(20	(20	(20	...	5.5 *	3.5 *	7.46 *
P23301 019DA4 19 JAN 83	369 *	N.D.	(.2	(20	(20	(20	(20	(20	...	5.5 *	2.39 *	7.49 *
P23302 110DA4 20 APR 83	347 *	N.D.	(.2	(20	(20	(20	(20	(20	200 *	5.85 *	7 *	7.35 *
P23303 214DA4 2 AUG 83	1070 *	N.D.	.49 *	(20	(20	(20	(20	(20	200 *	4.5 *	6.66 *	7.18 *
P23301 172DA4 20 JUN 84	335 *	(1	(.2	(20	(20	(20	(20	(20	192 *	6 *	3.96 *	7.85 *

DEWATERING WELL #34

DEWATERING WELL #34	DIMP	DCPD	DBCP	CPHS	CPHSO	CPHSO2	DITH	OXAT	CL	F	TOC	pH
P23401 019DA5 19 JAN 82	290 *	...	(.2	...	...	...	...	...	...	4.1 *	...	...
P23402 125DA5 5 MAY 82	432 *	...	(.2	...	...	...	...	...	...	4 *	...	...
P23403 201DA5 20 JUL 82	647 *	N.D.	(.2	(20	(20	(20	25.4 *	(20	...	4 *	4.4 *	7.8 *
P23404 292DA5 19 OCT 82	434 *	N.D.	(.2	(20	(20	(20	27.5 *	(20	...	4.1 *	4.2 *	7.14 *
P23401 019DA5 19 JAN 83	472 *	N.D.	(.2	(20	(20	(20	23.8 *	(20	...	4.3 *	2.39 *	7.33 *
P23402 110DA5 20 APR 83	537 *	N.D.	(.2	(20	(20	(20	23.4 *	(20	200 *	4.15 *	4.4 *	7.27 *
P23403 214DA5 2 AUG 83	406 *	N.D.	(.2	(20	(20	(20	(20	(20	200 *	4.1 *	4.04 *	7.64 *
P23401 172DA5 20 JUN 84	460 *	(1	(.2	(20	(20	(20	(20	(20	178 *	6 *	4.25 *	7.68 *

DEWATERING WELL #35

DEWATERING WELL #35	DIMP	DCPD	DBCP	CPHS	CPHSO	CPHSO2	DITH	OXAT	CL	F	TOC	pH
P23501 019DA6 19 JAN 82	413 *	...	(.2	...	...	...	...	...	...	4.1 *	...	...
P23502 125DA6 5 MAY 82	616 *	...	(.2	...	...	...	...	...	...	4 *	...	...
P23503 201DA6 20 JUL 82	722 *	N.D.	(.2	(20	(20	(20	(20	(20	...	4 *	4.9 *	7.66 *
P23504 292DA6 19 OCT 82	535 *	N.D.	(.2	(20	(20	(20	(20	(20	...	4.4 *	4 *	7.44 *
P23501 019DA6 19 JAN 83	601 *	N.D.	(.2	(20	(20	(20	(20	(20	...	4.5 *	3.53 *	7.49 *
P23502 110DA6 20 APR 83	838 *	N.D.	(.2	(20	(20	(20	(20	(20	200 *	3.15 *	3.8 *	7.39 *
P23503 214DA6 2 AUG 83	591 *	N.D.	(.2	(20	(20	(20	(20	(20	200 *	3.57 *	4.81 *	7.16 *
P23501 172DA6 20 JUN 84	443 *	(1	(.2	(20	(20	(20	(20	(20	216 *	6 *	4.25 *	7.85 *

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ANALYTE CONCENTRATION IN NORTH BOUNDARY DEWATERING WELLS

DEWATERING WELL #36

USER SAMPLE NUMBER	DATE SAMPLE COLLECTED	DIMP ug/l	DCPD ug/l	DRCP ug/l	CPHS ug/l	CPHSO ug/l	CPHSO2 ug/l	DITH ug/l	OXAT ug/l	CL mg/l	F mg/l	TOC mg/l	pH
P23601	019SA1 19 JAN 82	110	...	(.2	...	...	...	...	...	...	1.12	...	...
P23602	145SA1 25 MAY 82	582	...	(.2	...	...	...	...	...	...	1.5	...	...
P23603	201SA1 20 JUL 82	330	N.D.	(.2	(20	(20	(20	(20	(20	...	1	5.4	8.38
P23604	292SA1 19 OCT 82	158	N.D.	(.2	(20	(20	(20	(20	(20	...	.88	3	9.77
P33601	025SA1 25 JAN 83	110	N.D.	(.2	(20	(20	(20	(20	(20	...	1.1	.6	8.12
P33602	117SA1 27 APR 83	110	N.D.	(.2	(20	(20	(20	(20	(20	...	...	9	8.11
P33603	229SA1 17 AUG 83	110	N.D.	(.2	(20	(20	(20	(20	(20	100	1.46	...	8.24
P43601	172SA1 20 JUN 84	110	(1	(.2	(20	(20	(20	(20	(20	103	1.3	3.4	9.18

DEWATERING WELL #37

USER SAMPLE NUMBER	DATE SAMPLE COLLECTED	DIMP ug/l	DCPD ug/l	DRCP ug/l	CPHS ug/l	CPHSO ug/l	CPHSO2 ug/l	DITH ug/l	OXAT ug/l	CL mg/l	F mg/l	TOC mg/l	pH
P23701	026SA2 26 JAN 82	2040	...	(.2	...	...	...	...	...	...	1.4	...	...
P23702	145SA2 25 MAY 82	7710	...	(.2	...	...	...	...	...	...	2	4.9	7.65
P23703	201SA2 20 JUL 82	5020	N.D.	(.2	(20	(20	(20	(20	(20	...	2	5.1	7.27
P23704	299SA2 26 OCT 82	685	N.D.	(.2	(20	(20	(20	(20	(20	...	1.95	2	7.65
P33701	025SA2 25 JAN 83	1470	N.D.	(.2	(20	(20	(20	(20	(20	...	1.6	...	7.1
P33702	117SA2 27 APR 83	4870	...	(.2	(20	(20	(20	(20	(20	900	1.87	10	7.78
P33703	229SA2 17 AUG 83	2610	N.D.	(.2	(20	(20	(20	(20	(20	...	...	...	...

DEWATERING WELL #38

USER SAMPLE NUMBER	DATE SAMPLE COLLECTED	DIMP ug/l	DCPD ug/l	DRCP ug/l	CPHS ug/l	CPHSO ug/l	CPHSO2 ug/l	DITH ug/l	OXAT ug/l	CL mg/l	F mg/l	TOC mg/l	pH
P23801	026SA3 26 JAN 82	1020	...	(.2	...	...	...	...	...	...	1.6	...	...
P23802	145SA3 25 MAY 82	1120	...	(.2	...	...	...	...	...	...	2	4.4	7.73
P23803	201SA3 20 JUL 82	1850	N.D.	(.2	(20	(20	(20	(20	(20	...	2.5	(2	7.43
P23804	292SA3 19 OCT 82	1410	N.D.	(.2	(20	(20	(20	(20	(20	...	2.1	3	7.92
P33801	025SA3 25 JAN 83	1600	N.D.	(.2	(20	(20	(20	(20	(20	...	...	...	7.22
P33802	117SA3 27 APR 83	1450	N.D.	(.2	(20	(20	(20	(20	(20	500	2.45	10	7.22
P33803	299SA3 26 OCT 83	1390	(1	(.2	(20	(20	(20	(20	(20	112	2.2	6	0.26
P43801	179DC1 27 JUN 84	770	...	(.2	(20	(20	(20	(20	(20	...	...	...	7.39

DEWATERING WELL #39

USER SAMPLE NUMBER	DATE SAMPLE COLLECTED	DIMP ug/l	DCPD ug/l	DRCP ug/l	CPHS ug/l	CPHSO ug/l	CPHSO2 ug/l	DITH ug/l	OXAT ug/l	CL mg/l	F mg/l	TOC mg/l	pH
P23901	026SA4 26 JAN 82	52.3	...	(.2	...	...	...	...	...	...	1.3	...	...
P23902	145SA4 25 MAY 82	288	...	(.2	...	...	...	...	...	...	2	2.4	7.86
P23903	201SA4 20 JUL 82	294	N.D.	(.2	(20	(20	(20	(20	(20	...	1.5	2	7.47
P23904	292SA4 19 OCT 82	130	N.D.	(.2	(20	(20	(20	(20	(20	...	2	3.5	7.98
P33901	025SA4 25 JAN 83	191	N.D.	(.2	(20	(20	(20	(20	(20	...	1.8	2	7.32
P33902	117SA4 27 APR 83	229	N.D.	(.2	(20	(20	(20	(20	(20	400	2.03	20	8.51
P33903	229SA4 17 AUG 83	73.6	N.D.	(.2	(20	(20	(20	(20	(20

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ANALYTE CONCENTRATION IN NORTH BOUNDARY DEWATERING WELLS

DEWATERING WELL #40

USER SAMPLE NUMBER	DATE SAMPLE COLLECTED	DIMP ug/l	DCPD ug/l	DRCP ug/l	CPHS ug/l	CPHSO ug/l	CPHSO2 ug/l	DITH ug/l	OXAI ug/l	CL mg/l	F mg/l	TOC mg/l	pH
P24001	026SA5 26 JAN 82	(10	...	(.2	...	...	...	...	...	...	43	...	...
P24002	145SA5 25 MAY 82	(10	...	(.2	...	...	...	...	...	...	5	...	...
P24003	201SA5 20 JUL 82	(10	N.D.	(.2	(20	(20	(20	(20	(20	...	4	3.4	7.82
P24004	299SA5 26 OCT 82	(10	N.D.	(.2	(20	(20	(20	(20	(20	...	24	(2	7.07
P34001	025SA5 25 JAN 83	13.6	N.D.	(.2	(20	(20	(20	(20	(20	...	39	3	8.82

DEWATERING WELL #41

USER SAMPLE NUMBER	DATE SAMPLE COLLECTED	DIMP ug/l	DCPD ug/l	DRCP ug/l	CPHS ug/l	CPHSO ug/l	CPHSO2 ug/l	DITH ug/l	OXAI ug/l	CL mg/l	F mg/l	TOC mg/l	pH
P24101	026SA6 26 JAN 82	794	...	(.2	...	...	...	...	...	...	13	...	...
P24102	145SA6 25 MAY 82	392	...	(.2	...	...	...	...	...	...	3.5	...	...
P24102	032SA6 1 FEB 82	...	...	...	...	...	...	...	...	...	5.2	...	...
P24103	201SA6 20 JUL 82	867	2000	(.2	(20	(20	26.8	32.2	(20	...	4.5	12.4	7.68
P24104	299SA6 26 OCT 82	561	2000	(.2	(20	(20	63.4	37.8	(20	...	4	16	7.27
P34101	025SA6 25 JAN 83	586	2000	(.2	(20	(20	(20	(20	(20	...	3.8	8	7.87
P34102	117SA6 27 APR 83	696	N.D.	(.2	(20	(20	33.4	30.4	(20	...	...	...	7.17
P34103	229SA6 17 AUG 83	523	1605	1.48	33.4	28.7	46	(20	(20	400	4.9	10	7.98
P44101	179SA6 27 JUN 84	486	606	1.83	(20	40.5	39.6	(20	(20	350	5	(3	9.39

DEWATERING WELL #42

USER SAMPLE NUMBER	DATE SAMPLE COLLECTED	DIMP ug/l	DCPD ug/l	DRCP ug/l	CPHS ug/l	CPHSO ug/l	CPHSO2 ug/l	DITH ug/l	OXAI ug/l	CL mg/l	F mg/l	TOC mg/l	pH
P24201	026SA7 26 JAN 82	704	...	.52	...	...	...	...	...	...	6	...	...
P24202	145SA7 25 MAY 82	(10	...	.84	...	...	...	...	...	...	3.3	...	...
P24202	032SA7 1 FEB 82	...	...	...	...	...	...	...	...	...	5	...	...
P24203	202SA7 21 JUL 82	585	2000	...	(20	(20	54	26.7	(20	...	3.1	7.6	7.34
P24204	299SA7 26 OCT 82	523	2000	1.90	53.9	70	(20	23.5	(20	...	3.0	12	6.83
P34201	025SA7 25 JAN 83	533	1000	4.1	114	(20	67.4	23.5	(20	...	...	7	7.62
P34202	117SA7 27 APR 83	505	400	8.24	112	77.1	51.6	(20	(20	300	4.5	10	6.91
P34203	299SA7 26 OCT 83	521	1384	6.66	122	45.9	52.3	(20	(20	220	5	(3	8.39
P44201	179SA7 27 JUN 84	422	132	6	53.7	85.8	33.3	(20	(20	...	...	...	7.38

DEWATERING WELL #43

USER SAMPLE NUMBER	DATE SAMPLE COLLECTED	DIMP ug/l	DCPD ug/l	DRCP ug/l	CPHS ug/l	CPHSO ug/l	CPHSO2 ug/l	DITH ug/l	OXAI ug/l	CL mg/l	F mg/l	TOC mg/l	pH
P24301	026SA8 26 JAN 82	(10	...	(.2	...	...	...	...	...	...	49	...	...
P24302	144SA8 24 MAY 82	(10	...	(.2	...	...	...	...	...	...	5	...	...
P24303	202SA8 21 JUL 82	12.4	...	...	(20	(20	(20	(20	(20	...	6	(3	7.13
P24304	299SA8 26 OCT 82	13.3	N.D.	(.2	(20	(20	(20	(20	(20	...	55	(2	6.92
P34301	025SA8 25 JAN 83	18.9	1	(.2	(20	(20	(20	(20	(20	...	64	1	7.98
P34302	117SA8 27 APR 83	17.8	...	(.2	(20	(20	(20	(20	(20	200	7.11
P34303	229SA8 17 AUG 83	32.3	20	(.2	(20	(20	(20	(20	(20	200	84	10	8.1

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ANALYTE CONCENTRATION IN NORTH BOUNDARY DEWATERING WELLS

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DEWATERING WELL #40

	DIMP	DCPD	DBCP	CPHS	CPHSO	CPHSO2	DITH	OXAI	CL	F	TOC	pH
	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	
P24001 026SA5 26 JAN 82	(10		(.2							43		
P24002 145SA5 25 MAY 82	(10		(.2							5		
P24003 201SA5 20 JUL 82	(10	N.D.	(.2	(20	(20	(20	(20	(20		4	3.4	7.02
P24004 299SA5 26 OCT 82	(10	N.D.	(.2	(20	(20	(20	(20	(20		24	(2	7.07
P34001 025SA5 25 JAN 83	13.6	N.D.	(.2	(20	(20	(20	(20	(20		39	3	0.02

DEWATERING WELL #41

	DIMP	DCPD	DBCP	CPHS	CPHSO	CPHSO2	DITH	OXAI	CL	F	TOC	pH
	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	
P24101 026SA6 26 JAN 82	294		(.2							13		
P24102 145SA6 25 MAY 82	392		(.2							3.5		
P24102 032SA6 1 FEB 82										5.2		
P24103 201SA6 20 JUL 82	067	2000	(.2	(20	(20	26.0	32.2	(20		4.5	12.4	7.60
P24104 299SA6 26 OCT 82	561	2000	(.2	(20	(20	63.4	37.8	(20		4	16	7.22
P34101 025SA6 25 JAN 83	586	2000	(.2	(20	(20	(20	(20	(20		3.8	8	7.07
P34102 117SA6 27 APR 83	696	N.D.	(.2	(20	(20	33.4	30.4	(20				7.17
P34103 229SA6 17 AUG 83	523	1605	1.48	33.4	20.7	46.	(20	(20	400	4.9	10	7.90
P44101 179SA6 27 JUN 84	406	606	1.83	(20	40.5	39.6	(20	(20	350	5	(3	9.39

DEWATERING WELL #42

	DIMP	DCPD	DBCP	CPHS	CPHSO	CPHSO2	DITH	OXAI	CL	F	TOC	pH
	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	
P24201 026SA7 26 JAN 82	704		.52							6		
P24202 145SA7 25 MAY 82	(10		.84							3		
P24202 032SA7 1 FEB 82										3.3		
P24203 202SA7 21 JUL 82	505	2000		(20	(20	54	26.7	(20			7.6	7.34
P24204 299SA7 26 OCT 82	523	2000	1.90	53.9	70	(20	23.5	(20		3.1	12	6.83
P34201 025SA7 25 JAN 83	533	1000	4.1	114	(20	67.4	23.5	(20		3.0	7	7.62
P34202 117SA7 27 APR 83	505	400	8.24	112	77.1	51.6	(20	(20				6.91
P34203 299SA7 26 OCT 83	521	1304	6.66	122	45.9	52.3	(20	(20	300	4.5	10	8.39
P44201 179SA7 27 JUN 84	422	132	6	53.7	85.8	33.3	(20	(20	220	5	(3	7.30

DEWATERING WELL #43

	DIMP	DCPD	DBCP	CPHS	CPHSO	CPHSO2	DITH	OXAI	CL	F	TOC	pH
	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	
P24301 026SA8 26 JAN 82	(10		(.2							49		
P24302 144SA8 24 MAY 82	(10		(.2							5		
P24303 202SA8 21 JUL 82	12.4	4		(20	(20	(20	(20	(20		6	(3	7.13
P24304 299SA8 26 OCT 82	13.3	N.D.	(.2	(20	(20	(20	(20	(20		55	(2	6.92
P34301 025SA8 25 JAN 83	18.9	1	(.2	(20	(20	(20	(20	(20		64	1	7.90
P34302 117SA8 27 APR 83	17.8		(.2	(20	(20	(20	(20	(20				7.11
P34303 229SA8 17 AUG 83	32.3	20	(.2	(20	(20	(20	(20	(20	200	04	10	0.1

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***** ANALYTE CONCENTRATION IN NORTH BOUNDARY DEWATERING WELLS *****

DEWATERING WELL #44

	DIMP	DCPD	DRCP	CPHS	CPHSO	CPMSO2	DITH	OXAT	CL	F	TOC	pH
	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	mg/l	mg/l	mg/l	
P24401	026SA9 26 JAN 82	11.6 *	(.2)	(.2)	(.2)	(.2)	(.2)	(.2)	(.2)	32		
P24402	144SA9 24 MAY 82	(10)	(.2)	(.2)	(.2)	(.2)	(.2)	(.2)	(.2)	5	3.9	7.31 *
P24403	201SA9 20 JUL 82	N.D.	(.2)	(.2)	(.2)	(.2)	(.2)	(.2)	(.2)	2	(2)	7.2 *
P24404	299SA9 26 OCT 82	N.D.	(.2)	(.2)	(.2)	(.2)	(.2)	(.2)	(.2)	26	8	7.91 *
P34401	025SA9 25 JAN 83	(10)	(.2)	(.2)	(.2)	(.2)	(.2)	(.2)	(.2)	34		6.99 *
P34402	117SA9 27 APR 83	(10)	(.2)	(.2)	(.2)	(.2)	(.2)	(.2)	(.2)	42	9	7.97 *
P34403	299SA9 26 OCT 83	(10)	(.2)	(.2)	(.2)	(.2)	(.2)	(.2)	50	4	5	7.24 *
P44401	179SA9 27 JUN 84	(10)	(.2)	(.2)	(.2)	(.2)	(.2)	(.2)	55.1 *			

DEWATERING WELL #45

	DIMP	DCPD	DRCP	CPHS	CPHSO	CPMSO2	DITH	OXAT	CL	F	TOC	pH
	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	mg/l	mg/l	mg/l	
P24501	026SAA 26 JAN 82	(10)	(.2)	(.2)	(.2)	(.2)	(.2)	(.2)	(.2)	3		
P24502	144SAA 24 MAY 82	(10)	(.2)	(.2)	(.2)	(.2)	(.2)	(.2)	(.2)	5	3.9	7.35 *
P24503	201SAA 20 JUL 82	N.D.	(.2)	(.2)	(.2)	(.2)	(.2)	(.2)	(.2)	2	(2)	6.99 *
P24504	299SAA 26 OCT 82	N.D.	(.2)	(.2)	(.2)	(.2)	(.2)	(.2)	(.2)	2		6.74 *
P34502	117SAA 27 APR 83	(10)	(.2)	(.2)	(.2)	(.2)	(.2)	(.2)	00	42	5	7.73 *
P34503	236SAA 24 AUG 83	(10)	(.2)	(.2)	(.2)	(.2)	(.2)	(.2)	70.2 *	3	4.2	7.13 *
P44501	179SAA 27 JUN 84	(10)	(.2)	(.2)	(.2)	(.2)	(.2)	(.2)				

DEWATERING WELL #46

	DIMP	DCPD	DRCP	CPHS	CPHSO	CPMSO2	DITH	OXAT	CL	F	TOC	pH
	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	mg/l	mg/l	mg/l	
P24601	026SAB 26 JAN 82	219 *	(.2)	(.2)	(.2)	(.2)	(.2)	(.2)	(.2)	33	2	7.52 *
P34601	025SAB 25 JAN 83	(10)	(.2)	(.2)	(.2)	(.2)	(.2)	(.2)		27		

DEWATERING WELL #47

	DIMP	DCPD	DRCP	CPHS	CPHSO	CPMSO2	DITH	OXAT	CL	F	TOC	pH
	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	mg/l	mg/l	mg/l	
P24703	201SC1 20 JUL 82	(10)	(.2)	(.2)	(.2)	(.2)	(.2)	(.2)	(.2)	1	3.4	8.23 *
P24704	299SC1 26 OCT 82	(10)	(.2)	(.2)	(.2)	(.2)	(.2)	(.2)		23	(2)	8.73 *
P34701	025SC1 25 JAN 83	(10)	(.2)	(.2)	(.2)	(.2)	(.2)	(.2)		58	6	10.46 *
P34702	117SC1 27 APR 83	(10)	(.2)	(.2)	(.2)	(.2)	(.2)	(.2)		64	11	10.34 *
P34703	236SC1 24 AUG 83	(10)	(.2)	(.2)	(.2)	(.2)	(.2)	(.2)	60.6 *			9.39 *

... = NOT ANALYZED N.D. = NOT DETECTED * = POSITIVE FOUND (= LESS THAN INDICATED CONCENTRATION

USER DATE
SAMPLE I.D. SAMPLE
NUMBER NUMBER COLLECTED

ANALYTE CONCENTRATION IN NORTH BOUNDARY DEWATERING WELLS

DEWATERING WELL #40	DIMP ug/l	DCPD ug/l	DRCP ug/l	CPHS ug/l	CPHSO ug/l	CPHSO2 ug/l	OXAT ug/l	CL mg/l	F mg/l	TOC mg/l	pH
P24001 026SC2 26 JAN 82	(10	N.D.	(.2	(20	(20	(20	(20	...	1.5	3.9	0.33
P24003 201SC2 20 JUL 82	(10	N.D.	(.2	(20	(20	(20	(20	...	1.1	(2	0.10
P24004 299SC2 26 OCT 82	(10	N.D.	(.2	(20	(20	(20	(20	...	1.1	1	0.46
P34001 025SC2 25 JAN 83	(10	N.D.	(.2	(20	(20	(20	(20	...	1.36	7	7.93
P34002 117SC2 27 APR 83	(10	N.D.	(.2	(20	(20	(20	(20	67.1	1.4	4.2	7.96
P34003 236SC2 24 AUG 83	(10	...	(.2	(20	(20	(20	(20	60.9	...	...	...
P44001 179SC2 27 JUN 04	(10	...	(.2	(20	(20	(20	(20	...	...	...	...
DEWATERING WELL #49	DIMP ug/l	DCPD ug/l	DRCP ug/l	CPHS ug/l	CPHSO ug/l	CPHSO2 ug/l	OXAT ug/l	CL mg/l	F mg/l	TOC mg/l	pH
P24901 026SC3 26 JAN 82	(10	N.D.	(.2	(20	(20	(20	(20	...	1.1	4.4	0.1
P24903 201SC3 20 JUL 82	(10	N.D.	(.2	(20	(20	(20	(20	...	1.5	(2	7.15
P24904 299SC3 26 OCT 82	(10	N.D.	(.2	(20	(20	(20	(20	...	86	1	7.93
P34901 025SC3 25 JAN 83	(10	N.D.	(.2	(20	(20	(20	(20	...	1.39	8	8.02
P34902 117SC3 27 APR 83	(10	N.D.	(.2	(20	(20	(20	(20	35.2	1.9	4.5	7.92
P34903 236SC3 24 AUG 83	(10	...	(.2	(20	(20	(20	(20	25.7	...	...	...
P44901 179SC3 27 JUN 84	(10	...	(.2	(20	(20	(20	(20	...	...	...	...
DEWATERING WELL #50	DIMP ug/l	DCPD ug/l	DRCP ug/l	CPHS ug/l	CPHSO ug/l	CPHSO2 ug/l	OXAT ug/l	CL mg/l	F mg/l	TOC mg/l	pH
P25001 026SC4 26 JAN 82	(10	...	(.2	(20	(20	(20	(20	...	74	...	...
P25002 144SC4 24 MAY 82	(10	...	(.2	(20	(20	(20	(20	...	1	2.9	0.27
P25003 201SC4 20 JUL 82	(10	N.D.	(.2	(20	(20	(20	(20	...	82	(2	7.02
P25004 299SC4 26 OCT 82	(10	N.D.	(.2	(20	(20	(20	(20	...	72	4	0.6
P35001 025SC4 25 JAN 83	(10	N.D.	(.2	(20	(20	(20	(20	...	92	5	9.42
P35002 117SC4 27 APR 83	(10	N.D.	(.2	(20	(20	(20	(20	23.9	9	4.5	0.23
P35003 236SC4 24 AUG 83	(10	N.D.	(.2	(20	(20	(20	(20	21.3	...	...	7.06
P45001 179SC4 27 JUN 84	(10	...	(.2	(20	(20	(20	(20	...	...	...	...
DEWATERING WELL #51	DIMP ug/l	DCPD ug/l	DRCP ug/l	CPHS ug/l	CPHSO ug/l	CPHSO2 ug/l	OXAT ug/l	CL mg/l	F mg/l	TOC mg/l	pH
P25101 026SC5 26 JAN 82	(10	...	(.2	(20	(20	(20	(20	...	1.1	...	...
P25102 144SC5 24 MAY 82	(10	...	(.2	(20	(20	(20	(20	...	1	3.4	0.02
P25103 201SC5 20 JUL 82	(10	N.D.	(.2	(20	(20	(20	(20	...	1.5	(2	7.54
P25104 299SC5 26 OCT 82	(10	N.D.	(.2	(20	(20	(20	(20	...	1.5	1	0.07
P35101 025SC5 25 JAN 83	(10	1	(.2	(20	(20	(20	(20	...	1.74	8	7.52
P35102 117SC5 27 APR 83	(10	N.D.	(.2	(20	(20	(20	(20	40.4	1.3	5	0.04
P35103 236SC5 24 AUG 83	(10	N.D.	(.2	(20	(20	(20	(20	57.1	7.56
P45101 179SC5 27 JUN 04	(10	...	(.2	(20	(20	(20	(20

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USER USER DATE
SAMPLE I.D. SAMPLE
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ANALYTE CONCENTRATION IN NORTH BOUNDARY DEWATERING WELLS

DEWATERING WELL #52	DIMP ug/l	DCPD ug/l	DBCP ug/l	CPHS ug/l	CPHSO ug/l	CPHSO2 ug/l	DITH ug/l	OXAT ug/l	CL ug/l	F ug/l	TOC mg/l	pH
P25201 026SC6 26 JAN 82	(10)	...	(.2)	...	...	...	...	...	...	.6	...	...
P25202 144SC6 24 MAY 82	51	...	(.2)	...	...	...	...	...	...	.5	...	...
P25203 201SC6 20 JUL 82	(5)	N.D.	(.2)	(20)	(20)	(20)	(20)	(20)	...	.6	6.4	8.08
P25204 299SC6 26 OCT 82	(10)	N.D.	(.2)	(20)	(20)	(20)	(20)	(20)	...	.61	(2)	7.73
P35201 025SC6 25 JAN 83	(10)	1	(.2)	(20)	(20)	(20)	(20)	(20)	...	.61	4	8
P35202 117SC6 27 APR 83	(10)	...	(.2)	(20)	(20)	(20)	(20)	(20)	...	.70	...	7.61
P35203 236SC6 24 AUG 83	(10)	N.D.	(.2)	(20)	(20)	(20)	(20)	(20)	(20)	.7	6	7.79
P45201 179SC6 27 JUN 84	(10)	...	(.2)	(20)	(20)	(20)	(20)	(20)	22.5	7	6	7.92
DEWATERING WELL #53	DIMP ug/l	DCPD ug/l	DBCP ug/l	CPHS ug/l	CPHSO ug/l	CPHSO2 ug/l	DITH ug/l	OXAT ug/l	CL ug/l	F ug/l	TOC mg/l	pH
P25301 026SC7 26 JAN 82	(10)	...	(.2)	...	...	...	...	...	...	.63	...	...
P25302 144SC7 24 MAY 82	(10)	...	(.2)	...	...	...	...	...	...	.5	...	...
P25303 201SC7 20 JUL 82	(5)	N.D.	(.2)	(20)	(20)	(20)	(20)	(20)	...	.6	4.9	7.23
P25304 299SC7 26 OCT 82	(10)	N.D.	(.2)	(20)	(20)	(20)	(20)	(20)	...	.63	(2)	7.27
P35301 025SC7 25 JAN 83	(10)	N.D.	(.2)	(20)	(20)	(20)	(20)	(20)	...	.43	4	7.66
P35302 117SC7 27 APR 83	(10)	...	(.2)	(20)	(20)	(20)	(20)	(20)	...	.65	...	7.07
P35303 236SC7 24 AUG 83	(10)	N.D.	(.2)	(20)	(20)	(20)	(20)	(20)	28.3	.6	8	7.88
P45301 179SC7 27 JUN 84	(10)	...	(.2)	(20)	(20)	(20)	(20)	(20)	38.8	.6	6.2	7.79
DEWATERING WELL #54	DIMP ug/l	DCPD ug/l	DBCP ug/l	CPHS ug/l	CPHSO ug/l	CPHSO2 ug/l	DITH ug/l	OXAT ug/l	CL ug/l	F ug/l	TOC mg/l	pH
P25401 026SC8 26 JAN 82	(10)	...	(.2)	...	...	...	...	...	...	.03	...	...
P25402 144SC8 24 MAY 82	(10)	...	(.2)	...	...	...	...	...	...	1	...	...
P25403 201SC8 20 JUL 82	(5)	N.D.	...	(20)	(20)	(20)	(20)	(20)	...	1	(3)	7.47
P35401 025SC8 25 JAN 83	(10)	N.D.	(.2)	(20)	(20)	(20)	(20)	(20)	...	.79	1	7.46
P35402 117SC8 27 APR 83	(10)	...	(.2)	(20)	(20)	(20)	(20)	(20)	...	...	...	5.58
P35403 236SC8 24 AUG 83	(10)	N.D.	(.2)	(20)	(20)	(20)	(20)	(20)	162	1.16	7	7.9

(= LESS THAN INDICATED CONCENTRATION

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